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REPORT

OF THE

Mass.
COMMISSIONERS

ON inland

FISHERIES AND GAME

FOR THE

YEAR ENDING DECEMBER 31, 1908.

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COMMISSIONERS ON FISHERIES AND GAME.

GEORGE W. FIELD, Sharon, *Chairman.*
JOHN W. DELANO, Marion.
GEORGE H. GARFIELD, Brockton.

Chief Deputy Commissioner.
WILLIAM W. NIXON, Cambridge.

Clerk.
W. RAYMOND COLLINS, Boston.

DAVID L. BELDING, Chatham, *Biologist.*
FERDINAND C. LANE, Wellfleet, *Assistant Biologist.*
ARTHUR MERRILL, Sutton, *Superintendent.*

Office: Room 158, State House, Boston.

Telephone: Haymarket 2700.

Obituary.

On March 16, 1908, the senior commissioner, the Hon. Edward A. Brackett of Winchester, passed away, at the age of eighty-nine. For the past thirty-nine years Mr. Brackett's best efforts have been spent in the service of the State.

Born in Vassalboro, Me., 1818, of Quaker parentage, his naturally strong artistic proclivities, early manifested, were frowned upon, his father striving in vain to have him trained in some "useful trade." The early years of manhood were those of a struggling artist, — a sculptor, — with a strong predilection for poetic expression, as is evinced in his masterpiece, "The Shipwrecked Mother and Child," now in the Worcester Art Museum; and also in the faculty of giving so much expression to his busts, one of which, that of Washington Allston, is on the main staircase of the Metropolitan Museum of New York. (A duplicate in marble is also in the Worcester Museum.) One of his notable busts was that of John Brown, the measurements for which were taken in the prison a few days before Brown's execution. Mr. Brackett went to Charleston, Va., for this purpose during the trial, at a time when the feeling against the north was so strong that it was at the risk of his life that a Boston man ventured there. He made many other busts, including those of President William Henry Harrison, of the poets William Cullen Bryant, Richard H. Dana, Henry W. Longfellow, of Gen. B. F. Butler, Wendell Phillips and William Lloyd Garrison. He never made a memorandum of his art works, and they have been so scattered that but few of them can be traced. In 1861 Gov. John A. Andrew appointed him first lieutenant and battalion quartermaster in the First Massachusetts Cavalry. The following March he resigned, in consequence of reorganization of the cavalry, and returned home.

Always abreast with advanced thought, his innate mental tendency was that of a pioneer; he continually had some new avocation, *e.g.*, some experiment to work out, — running a winter greenhouse for grapes, cucumbers, roses and smilax; then rearing bees; again taking up some new psychological fad, as mesmerism, psychic subjects, etc. The pioneering work of Seth Green upon the maintenance of the shad and salmon by artificial propagation and the application of his discoveries and methods to the Connecticut and Merrimac rivers early attracted Mr. Brackett's interest, and he constructed a miniature hatchery in an old freight car, with runs, etc., and a small pond near, all supplied with good spring water, with which he could carry on his studies and experiments. This soon came to the ears of Colonel Lyman, the first member of the then newly created Commission on Inland Fisheries, and he was asked to work with and for them until 1869, when he was appointed a member of the Board by Governor Claflin. The "toy" hatchery became the nucleus of the present Winchester hatchery, the first State hatchery. The special form of a fishway devised by Mr. Brackett is still continued in successful operation both in the United States and Europe. His hatching tray also served as the type form, which has been modified in various directions to meet special needs.

The giving up of his art work, involving the dismantling of his studio, was one of the bitter trials of his life; but he resolutely laid aside his preference, and threw himself into the work that had come to him, making himself so efficient and of such authority that in his eighty-seventh year he received his eighth consecutive appointment for five years each.

Mr. Brackett served on the commission thirty-eight years and eight months, and for twenty-seven years, from 1872 to 1899, as chairman. His interests as commissioner were not confined to the inland fisheries, but he personally and actively investigated the changing conditions surrounding our native birds, particularly the game birds. The importance of game birds as a source of recreation and food supply led Mr. Brackett, through Mr. S. Forehand of Worcester, to secure from Judge Denny from Oregon in 1895 the pheasant (*P.*

torquatus), which has become successfully naturalized in this State.

The dominant traits of character were versatility, rugged integrity and perseverance in surmounting obstacles, a sunny optimism and friendliness, — the characteristics of "a good neighbor," — which made him a notably successful public servant.

The following resolutions were adopted by the Board: —

Whereas, The passing of the senior member of this commission, Hon. E. A. Brackett, who, for thirty-eight years and eight months, with conspicuous energy, fidelity and integrity served the Commonwealth, and for twenty-seven years, so long as his strength permitted, as the leader in thought and action in the work of this commission; and

Whereas, This Board, ever since his retirement from active participation in the daily routine, has depended upon his mature deliberation, ripe experience and wise counsels; therefore, be it

Resolved, That, while bowing reverently to the decree of the Divine will, the undersigned, members of this board, deeply feel the personal loss, the warm friendly greeting and the ripened counsel of our venerated colleague, and extend their profound sympathy to his family and relatives.

Resolved, That these resolutions be spread upon the records, and a copy thereof be sent to the widow.

George W. Field.
John W. Delano.

On July 8, 1908, His Excellency Governor Guild nominated, for the term of five years, ex-Senator George H. Garfield of Brockton, as a member of the Commission on Fisheries and Game, and on the 15th the appointment was confirmed.

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The Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-third annual report.

General Considerations.

The special duty of the commissioners is to deal with those relations which already exist, and the new problems which are constantly arising concerning the wise utilization of valuable assets of the Commonwealth, involving the intelligent conservation, protection and utilization of the inland fisheries and game, valuable as a source of food and recreation; the protection of the insectivorous birds, which are directly and indirectly of incalculable benefit to all classes of our citizens; and the conservation, development and economic utilization of our sea and shore fisheries. We aim to perform our duties in such a manner as to act co-ördinately with other State and municipal officials. Without narrow-minded specialization we strive to study the subjects under our charge, and seek to merit the confidence not only of the general public but also of the legislative and executive branches of our government, who from the force of the circumstances cannot always command the time necessary to study the fish and game problems at first hand and in the broadest and most detailed manner. We are of the opinion that this department can and should be made self-supporting. The small tax levied upon hunters (chapter 317, Acts of 1905, as amended by chapter 402, Acts of 1908, relative to unnaturalized, foreign-born persons; chapter 198, Acts of 1907, relative to non-resident hunters; and chapter 484, Acts of 1908, relative

to registration of resident hunters) should not only provide better protection for farmers, property owners and the useful birds, and check in a measurable degree disastrous forest fires by increasing the number of paid wardens (who in effect are a special rural police) in active service, but should provide funds for more effective stocking of waters with food fish and of covers with birds. The initiation of a system whereby the public fishing rights on the seashore may be leased for the purpose of increasing the yield of the mollusks from tidal flats, thus developing better business conditions in the shore towns, with increased opportunities for employment to our citizens, should yield a return to the citizens of the Commonwealth far in excess of the total annual expenditures of this commission. Of the subjects especially considered this year, detailed statements are given elsewhere in this report. These may be briefly summarized as follows: —

Expenditures. — The exact details of all expenditures are published in the annual report of the Auditor of the Commonwealth. In general, $6,000 was expended for the benefit of the sea and shore fisheries; $5,700 for maintenance of inland resources for the purchase and propagation of trout, quail, grouse and pheasants; $30,000 for the enforcement of the fish, game and bird laws on land and sea; $4,000 for the protection of the adult female lobsters by purchase of those caught when carrying eggs; $5,100 for salaries of the commissioners; and $4,100 for printing, postage, travelling expenses of the commissioners and for clerical and office expenses. The total amount of fines was $6,957.50; and of all other additional moneys received and turned into the treasury of the Commonwealth, $2,735.

Mollusk Fisheries. — In 1905 the Legislature ordered a biological survey of the coastal areas below high-water mark, in order to ascertain: —

(1) The present and past conditions of the mollusk fisheries.

(2) The possibilities of increasing the annual production by (*a*) increasing the annual yield per acre; (*b*) suitable methods of securing an annual yield from areas at present unproductive.

(3) Ascertaining definite methods of increasing production by study of: —

(*a*) Life histories of the economic mollusks, particularly the oyster, clam, quahaug and scallop.

(*b*) Methods of feeding and rate of growth.

(*c*) Effects of unfavorable conditions; *e.g.*, pollution.

(*d*) Methods of checking ravages of enemies; *e.g.*, starfish, "drills," "winkles," etc.

A report to the Legislature upon this work states, in general, that of upwards of 60,000 acres of shellfish ground only about 3,552 acres are to-day yielding anything approximating the natural yield, *i.e.*, from $100 to $800 profit per annum; while upwards of 40,000 acres are producing at least 90 per cent less than normal production; and about 15,000 acres at present unsuitable could at an expense of $50 to $300 per acre be made to yield from $100 to $500 profit annually. Under such development and utilization employment would be furnished to about 20,000 skilled and unskilled laborers, as compared with 2,184 in 1907; and a total production valued in the hands of the producers at $6,000,000 annually, instead of $752,000, as in 1907.

The results from more than 300 experimental plots prove conclusively that clams (*Mya arenaria*) and quahaugs (*Venus mercenaria*) can by appropriate methods be as successfully cultivated as are oysters to-day, or as any farm crop; that the value of a quahaug crop upon arrival at a marketable size often exceeds $1,800 per acre; and that the annual profit should average not less than $200 per acre.

These fisheries are prosecuted upon what is now in the east the last remnant of the public domain, viz., between high and low tide marks. The titles to the uplands have been acquired by individuals, and are subject to individual control and responsibility; and the title of the riparian owner extends to mean low-water mark, or to 100 rods beyond the mean high-water mark in cases where more than 100 rods of tidal flats are exposed by the average tide, but the riparian owner does not have an exclusive control of the fishing, fowling and boating. He may participate in these only on equal terms with the public, and subject to the disposing right of the General Court. Similarly, State laws have been enacted by which areas below high-water mark may be leased for oyster cultivation, but the lease holder can claim as his property only the oysters grown thereon.

Curiously enough, present laws permit the cultivation of oysters in the waters below low-tide mark, but not clams, quahaugs or scallops, either below or above low-water mark. It would be quite as logical for the State to permit the farmer to grow only corn.

The fisheries (which include the mollusk fisheries) are still public, and subject to the disposing action of the Legislature. If the Legislature should by appropriate laws make possible intensive cultivation of shellfish, *e.g.*, the oyster, clam, quahaug, scallop and lobster, in the area below high-water mark, under proper safeguards devised to secure public and private rights, there would follow: —

(1) Increased opportunities for skilled and unskilled labor.

(2) Increased yield per acre above the natural productiveness.

(3) Increased daily profits in proportion to the time and labor of the fishermen.

(4) Increased definiteness of supply, thus permitting the fishermen to take advantage of market conditions.

(5) Increased income to town from taxable property on the shellfish beds.

(6) Increased subsidiary industries.

(7) Increased revenue to citizens, communities and State, from leases of public domain.

An extended discussion is to be found in a special report to the General Court upon the mollusk fisheries of Massachusetts.

Dogfish. — As stated in our previous reports, the aggregate annual damage during the past five years to Massachusetts' sea-fishing interests cannot be less than $5,000,000. Some unsuccessful attempts have been made by oil and fertilizer manufacturers in Massachusetts to utilize the dogfish. The chief obstacles have been lack of a regular and definite source of supply, and a lack of knowledge of the best and cheapest methods of securing the maximum yield of oil and fish scrap for fertilizer. Scientific studies are now under way for the purpose of furnishing a standard by which manufacturers may test the efficiency of their processes of extracting oil and making fish scrap for use in commercial fertilizers.

Lobster Fisheries. — As a direct result of the first annual

Conference of the Governors of the New England States, held at Boston, Nov. 23, 24, 1908, at a convention of the commissioners of the States of Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut, the following resolutions were adopted: —

That in the opinion of this convention a close season during a portion of the year is of greatest advantage to those who are in a position to deal with the lobster as a marketable commodity, but is of relatively little value in augmenting the total annual supply of lobsters, for the reason that the lobster is a slow breeder, and that the breeding season extends over at least ten months of the year.

If measurement is to be made the standard of legal length, the principle should be the measurement of the shell of the body, exclusive of the tail.

That it is the opinion of this convention that the artificial propagation and maintenance of the lobster up to at least the fourth stage in the development is of fundamental importance to the maintenance of the lobster fisheries of the United States.

That the Chair appoint the chairman or a representative from each of the commissions of the different States to confer within a short time, either by meeting or letter, as it seems best, with the New York commission concerning a uniform law relative to the legal length of the lobster, and report to this body.

That the chairman of this meeting is instructed to confer, either by letter or otherwise, with the commissioner of New York, looking towards the adoption of uniform laws on lines passed upon at this convention.

That it is the opinion of this convention that all the States should adopt the law which fixes at not less than 4¾ inches, as measured by the Maine standard, the size of lobsters legally taken.

That it is the opinion of this convention that it is advisable to license all lobster fishermen, dealers, smack captains and persons catching or transporting lobsters.

We respectfully invite your special consideration of these resolutions, and we earnestly recommend that appropriate legislation be speedily enacted.

Inland Fisheries. — As a result of drought, directly traceable in very considerable measure to unwise methods of deforestation of our hills, many of the smaller brooks and the upper reaches of larger brooks, which are the nurseries of brook trout, have been entirely depopulated. In addition, we again repeat

the statements given in the previous reports, that we should not be longer compelled to maintain unwise, inadequate and unbusiness-like methods of stocking public waters. We respectfully urge consideration of an improved system of stocking, whereby certain well-known and suitable waters, definitely designated as public waters under the control of the Commonwealth, and adequately protected and stocked, are maintained at their highest productive capacity.

Our present system of propagating, rearing and distributing fish is antiquated, and, while entirely adequate to meet the conditions under which it was developed, was not planned with a view to future extension of facilities, and has become entirely incapable of meeting the present demands. Greater results can be obtained from one model hatchery, having a sufficient water supply to maintain a stock of selected brood fish, and with hatching house, trays and rearing pools sufficient to turn out annually 5,000,000 fry, at least 250,000 fingerling trout, and at least 1,000,000 white perch.

Many inquiries have been made relative to the State hatcheries, which were established by special acts of the Legislature, as follows: resolve 114, Acts of 1896, appropriating $3,000 for the establishment of a hatchery at Hadley; resolve 74, Acts of 1897, appropriating $3,000 for the establishment of a hatchery at Winchester; resolve 60, Acts of 1898, appropriating $2,500 for the establishment of a hatchery at Adams.

Previous to 1893 approximately 400,000 fry were annually received from the hatchery at Plymouth, N. H., the cost of maintenance of which the State of Massachusetts shared equally with New Hampshire. Since the establishment of the hatcheries at Winchester, Hadley and Adams the annual output from each has averaged about 200,000 trout fry. At the time of the establishment of those hatcheries there were practically no commercial hatcheries in the State, and the price at which the fish could be bought was at least five times that at which they may be bought at present. The total cost of maintaining the three small hatcheries for the rearing of fry only is less than $1,100 annually. The average aggregate output for the three hatcheries is about 600,000 fry, which at $1.50 per thousand would make the total yield valued at $900. The cost of distribution from

these three hatcheries, situated respectively in the eastern, the middle western and western part of the State, is very much less than if the entire distribution were made from the eastern part of the State, as might be necessary if the fish were purchased; so that, in our opinion, there is practically no difference in the cost of buying the fish and the cost of hatching by the State.

We are informed by the Massachusetts Bureau of Statistics of Labor that wild trout are taken in this State to the value of $66,000 per annum, at a total cost to the Commonwealth of about $5,000 in the maintenance of the above three hatcheries and of the Sutton hatchery, which latter annually produces about 200,000 fry and from 70,000 to 115,000 fingerlings, or a total for the State of 800,000 to 900,000 fry and 70,000 to 115,000 fingerlings.

The chief difficulties in the maintenance of fish in Massachusetts waters are connected with the excessive pollution of the larger streams and the deforestation of the mountain slopes, resulting in the drying up of the nursery brooks. There is absolutely no question that a larger plant of cultivated fish would be more economical to the State, and is beyond question necessary in order to secure proper results.

In reference to the abandonment of the hatcheries at Winchester, Adams and Hadley, the commissioners are of the opinion that it is not expedient at present to discontinue these hatcheries, for the reasons stated above; and we are further of the opinion that we would have no right to abandon them until ordered to do so by legislative act.

Game Birds. — In the pioneering work of devising methods of rearing game birds in captivity much progress has been made. The area available for rearing the birds has been so circumscribed and so subject to infectious diseases, from long occupation, that many untoward losses have been experienced which would not have occurred in a location suitable for breeding quail and ruffed grouse, where the ground and air were uncontaminated by disease germs from domestic poultry and the birds safe from the abandoned cat. A movement to establish "sanctuaries," wherein native birds may breed in safety, is under way. The State reservations should be increased and utilized, particularly for breeding and feeding refuges for native

birds. We venture to express the opinion that the breeding of pheasants perhaps may ultimately be safely left to private individuals.

Deer. — While it is certainly a fact that the wild lands of the State are well adapted for producing an annual crop of wild deer, an undue increase will without doubt entail hardship upon farmers and property owners. Every possible safeguard should be adopted to protect property and the rights of property owners. In the near future it may be necessary to control the increase of deer. A general open season, even for a very few days, would bring out an indiscriminate rush of inexperienced and irresponsible hunters. To prevent untoward results it may be necessary to issue a special license for deer hunting, with a fee sufficient to limit it to persons of responsibility, and to ensure to the State reimbursement for moneys paid to land owners for damage to crops by deer.

Conservation of the Song, Insectivorous and Game Birds, Valuable Mammals, Food and Game Fishes. — Destruction of the evergreen forests, unrestricted shooting, rats, squirrels and mice, the introduction of cats, and infectious diseases, have completely exterminated the wild turkey and passenger pigeon; the pinnated grouse and the upland plover are possibly beyond recall; the ruffed grouse, woodcock and quail are steadily diminishing. Of these possibly there remains an average of 5 or 10 per square mile, as compared with an original population of 50 or 100, or even more. Though formerly a breeding ground for the Canada goose, black ducks and wood ducks, our shortsightedness in shooting birds on their northern migration now permits relatively very few to stop here. Favorably located at the junction of two of the great paths of bird migration, and on account of the locally congested population, Massachusetts has an unusual percentage of her territory still unspoiled for raising the optimum crop of game and insectivorous birds. More complete utilization of these conditions would be of permanent value not alone to farmers, but to all classes of the community. It seems probable that the avian population (exclusive of the English sparrow) has now sunk to one-tenth or possibly one-hundredth of its natural number previous to the year 1620. Many of the conditions which caused this alarming decrease are

still active, and the decline still goes on, though perhaps at a somewhat diminished rate. The value of the insectivorous and song birds is entirely beyond estimation; but some approximate figures may be made of the value of the game birds, in addition to their beneficial capacity for destroying noxious insects. We are of the opinion that Massachusetts should produce an annual crop of at least 25,000 ruffed grouse (valued at $25,000 as food), at least 20,000 quail (valued at $5,000 as food, or better at ten times that amount as insect destroyers on the farm), and at least 25,000 black and wood ducks (valued at $15,000), and in addition the wild lands should produce an annual crop of 1,000 wild deer (valued at $25,000 as food). Besides this, there is reason to believe that not far from 50,000 to 100,000 people hunt and fish more or less in this State; and if it can be prosecuted with reasonable success here, between one and two millions of dollars will be spent annually in this State, instead of being diverted elsewhere for similar purposes of recreation.

Massachusetts is well studded with over 1,100 lakes and ponds. Of these, 860 are "State ponds" above 20 acres, and free to the public for fishing. The trout streams are numerous and very accessible. The State Bureau of Statistics of Labor is authority for the statement that the value of the wild trout taken in this Commonwealth in the year 1906 by hook and line was $66,000. The food value of the bass, pickerel, perch, hornpouts and eels is probably at least $10,000. We are safe in saying that not one of these ponds and streams is producing anywhere near its maximum capacity. Scientific knowledge of the rate of growth of the minute and even microscopic plants and animals, the fundamental food supply for young fish, is important, for the reason that the quantity of such plants and animals largely determines the number of adult fish which a given area of water can support. Reasonably complete knowledge of such facts is necessary before adequate and economical results can be secured by stocking. It is, however, absolutely certain that well-advised methods of stocking, based upon accurate knowledge, should increase at least tenfold the yield of edible and game fish in Massachusetts waters.

Marine Fisheries.

The commissioners have made a first-hand study of the practices in the Maritime Provinces, especially in reference to handling the dogfish, and incidentally to the lobster and mollusk fisheries in Nova Scotia and Cape Breton, New Brunswick and Prince Edward Island. They personally observed and studied the dogfish plant at Clark's Harbor and at Canso and Shippegan. These factories buy dogfish at $4 per ton and fish waste at $3 per ton, and turn them into oil and fish scrap, a small portion of which is sold to near-by farmers at $25 per ton, but the great bulk of oil and fertilizer is sold in the United States. The annual product varies from 100 to 300 tons of dried fish scrap, or sufficient to furnish nitrogen for 500 to 1,500 tons of complete commercial fertilizer. In addition to the benefits to agriculture by the production of fertilizer, the fisheries are relieved of a very considerable number of enemies; *i.e.,* each ton of dogfish scrap represents the destruction of approximately 37,000 dogfish. Every dogfish living to-day is being maintained at public expense as a boarder at nature's table, eating and destroying on an average not less than 1 to 5 pounds daily of commercially valuable food fish, worth at least, at a very conservative figure, 1 cent per pound. Thus it may be properly inferred that the dogfish destroy more fish than are caught by the combined fishing fleets of the world. Public attention is awakening to the fact that many of our most valued sources of food are certainly becoming depleted, viz., lobster, bluefish, mackerel, etc., and that it is absolutely essential to assist nature in order to maintain the supply. It is a sound economic principle that man may increase the natural supply of animal-plants suitable for human food, by developing new methods of protecting the eggs, the young and the adults from the natural enemies. This principle has been reduced to practice in the case of the domesticated animals and plants, and of the trout, salmon and other fish. The dogfish has become so destructive to our marine fisheries that some relief is necessary. Dogfish are not at present brought in commercial quantities to market, for the reason that no methods have been developed to make them commercially profitable. Gloucester and Boston, Mass., have the largest markets for salt

and fresh fish in North America; and naturally there should exist facilities for caring for waste products, from which oil, glue and fertilizer can be made. The dogfish can be profitably handled, even if treated in the same class as fish waste; though it is valued as a food fish in many countries, and the dried fins are sold at a high price (25 cents per pound) in the Orient, where they are regarded as a special delicacy.

Education relating to Fisheries. — One of the most essential requisites for the intelligent conservation of our marine resources is a well-defined system of education, adapted not alone for giving instruction in the principles and practices of fisheries enterprises, but of conveying to the public trustworthy statements pertaining to the legislative, civic, economic and sanitary problems involved; a fisheries museum, built up in a manner adapted for imparting knowledge, rather than merely as a collection of curiosities; a library of technical books and journals relative to the fisheries and allied subjects; models of the latest and most approved types of boats and gear of all descriptions; illustrated lectures and practical discussions and demonstrations upon pertinent subjects both in the line of handling the raw materials and of manufactured products of the fisheries; and a staff of competent scientists, who would be available for rapid and comprehensive investigation of problems which require special scientific training. The commercial and economic value of our fisheries cannot be overestimated. Other nations have developed fisheries schools and institutes, which are rendering efficient service.

The visit to Massachusetts of the delegates to the Fisheries Congress, and the many admirable demonstrations of fisheries methods provided at Boston, and particularly at Gloucester, were greatly admired by all, and proved to be a most effective advertisement of the practical knowledge, experience, skill, enterprise and efficient organization of those who are responsible for maintaining the prestige of the Massachusetts fisheries, and of the unsurpassed qualities of the products manufactured from the results of these fisheries. The delegates were vastly impressed with the admirable sanitary precautions taken to ensure cleanliness and healthfulness in the special preparations sold in cans and other packages, as well as the scientific develop-

ment of efficient methods of utilizing the incidental products formerly wasted. The rapid development of such trade is a tribute to the ability of the men at the helms, both on the sea and in the office, and to the industry, intelligence and fidelity of the employees, and promises prosperity not alone to the people living in special trade centers, but healthful and economical food to all the public at large, as well as a marked check upon the unwise and wasteful methods and utter disregard for the future supply which too often notoriously characterize the fishing trade.

The fisheries shared in the general market depression. While the catches were up to the general average, prices were below the normal.

Boston continues pre-eminently the market for fresh fish. The fleet included 302 sailing vessels, 1 steam otter trawler, 1 gasolene auxiliary steamer and 154 miscellaneous boats, chiefly gasolene.

The catch of fresh fish landed at Boston, as compiled by the Boston Fish Bureau, is shown below: —

Ground Fish.

YEAR.	Haddock.	Cod.	Hake.	Cusk.	Pollock.	Halibut.	Total.
1908, ...	37,581,600	27,502,000	11,365,800	1,668,100	6,617,400	301,550	85,036,450
1907, ...	36,082,200	29,274,950	9,963,400	2,324,200	4,244,100	215,630	82,104,480

Total Quantity of Fresh Fish of All Kinds landed at Boston.

YEAR.	Arrivals.	Ground Fish.	Other Fish.	Totals.
1903, ...	3,818	74,039,865	6,227,007	80,266,872
1904, ...	4,056	75,920,980	6,173,186	82,094,166
1905, ...	4,280	94,194,930	7,111,765	101,306,695
1906, ...	4,505	86,956,350	2,737,020	89,693,370
1907, ...	4,383	81,104,480	6,006,556	88,111,036
1908, ...	4,500	85,036,450	6,841,130	91,877,580

Best Stock of Massachusetts Vessels for Codfisheries.

Vessel.	Captain.	Gross Stock.
"Tattler,"	Alden Geel,	$24,364
"Arethusa (knockabout),"	Clayton Morrisey,	23,389
"J. J. Flaherty,"	Fred LeBlanc,	17,798
"Smuggler,"	Fred A. Morrisey,	15,558

Best Stock of Massachusetts Vessels for Fresh or "Shack" Fisheries.

Vessel.	Captain.	Gross Stock.
"Mary C. Santos,"	Manuel C. Santos,	$40,100
"Mary E. Cooney,"	Frank Cooney,	32,000
"Pontiac,"	Enos Nickerson,	32,000
"Thos. S. Gorton,"	William H. Thomas,	31,190
"W. M. Goodspeed,"	George Perry,	29,000

The Gloucester Fisheries. — The notable feature of the year in Gloucester, the home of the salt fish industries, was the ill success of the mackerel seiners, which was partially balanced by unusually good fortune in the banks codfishery, so that the total catch of the Gloucester fleet, in round numbers, was 100,000,000 pounds, generally regarded as an average and satisfactory catch. The value on the dock was not less than $5,000,000, which was increased to $8,000,000 by various processes of packing and manufacture.

The fishing season of 1908 at Gloucester was productive of many big stocks in the various branches of the fishery, and in some instances long-standing records were broken. Of course it is not to be supposed that these stocks represent fairly what the fleet did as a whole. Those mentioned below are the high liners in the different branches of the fishery, together with others that were up in the front rank, and as such are worthy of mention and credit.

In the mackerel fleet the schooner "A. M. Nicholson," commanded by the famous Capt. Solomon Jacobs, carried off the high line honor, with a stock of $21,000, each member of the

crew sharing $438. Captain Jacobs has held the honor of high line of the mackerel fleet more times than any skipper, and, although now one of the oldest in years as well as in point of service, is still able to keep in the front rank in this most trying and uncertain fishery.

Other notable stocks in this fishery were as follows: —

Schooner "Monarch," Capt. John F. Vautier, $18,017.18 stock and $360.74 share.

Schooner "Ingomar," Capt. Wallace Parsons, $17,983.58 stock and $403.74 share.

Schooner "Elizabeth Silsbee," Capt. John A. McKinnon, $16,874.58 stock and $336.88 share.

Schooner "Electric Flash," Capt. William Bissert, $16,-184.60 stock and $361.81 share.

Schooner "Clintonia," Capt. Ralph Webber, $13,711 stock and $292.72 share.

Schooner "Pinta," Capt. Douglass McLean, $13,120.45 stock and $280.93 share.

In the salt bank trawl codfishery the high liner was the new knockabout schooner, "Arethusa," Capt. Clayton Morrisey, one of the finest fishing vessels ever built. Her photograph was given in our report for 1907. This craft made two trips to the banks, sailing on the first February 27, returning June 20 and weighing off 389,000 pounds of salt cod; then sailing again June 30, returning October 27 and weighing off 350,000 pounds; giving her a season's total catch of 739,000 pounds, — an unusually large amount. On this was made the remarkable stock of $23,398.62, considered the largest season's work ever made at salt bank cod trawling. The crew made the notable share of $611.36.

Previous to going on her first bank trip, the "Arethusa's" maiden endeavor was a frozen herring trip to Newfoundland. After taking out her second bank trip last fall she again went on a Newfoundland trip, this time for salt herring, returning December 19. Since she was launched, thirteen months ago, she has made the remarkable stock of about $40,000. Capt. Clayton Morrisey, her commander, is one of the most notable figures in the North Atlantic fisheries, and although one of the

youngest, has carried off the high line honor for many seasons in succession.

Another excellent stock in this fishery was that of the schooner "Smuggler," Capt. Fred A. Morrisey, $15,558.98, the average share being $424, as result of the two trips.

Schooner "J. J. Flaherty," Capt. Fred LeBlanc, on one trawl and one dory handline trip made the fine stock of $17,-798.23, the average share being $328.12.

In the salt bank dory handline fishery another record was broken, the schooner "Tattler," Capt. Alden Geel, being the craft to perform the feat. Captain Geel made two trips, weighing off 674,764 pounds of salt cod and stocking $24,364.09, the high line share being $611.51. Previous to this the record had been held since 1902 by Capt. John McInnis, who in three trips that season in the schooner "Talisman" stocked $24,291.28, his high line share being $710.49, while 745,475 pounds of salt cod were weighed off as the result of the three trips.

Some notable single trips in the salt cod line in 1908 were as follows: —

Schooner "Ella M. Goodwin," Capt. James Goodwin, engaged in dory handlining, sailed July 1 and returned October 5, a very quick trip, weighing off 336,013 pounds of salt cod stocking $12,276.23, the average share being $248.19. The high liner of the crew, Edward Atkinson, made a share of $324.64, while four others of the crew went over the $300 mark.

Schooner "Arcadia," Capt. William Wharton, on a deck handline salt cod fishing trip to Western Bank weighed off 108,000 pounds of salt cod, stocking $3,800. On this trip the high line share was $150, while several of the crew made over $100. This is accounted the largest and most remunerative salt cod deck handline trip ever landed.

Schooner "Aloha," Capt. John McInnis, on a late salt cod dory handline trip to Grand Bank and Virgin Rocks weighed off 334,000 pounds of salt cod, stocking $11,712.07, the high line share being $283.51.

In the fresh halibut fishery the highliner from this port was the schooner "Cavalier," Capt. Robert Porper, with a stock of $21,248.32, the crew sharing $430.26.

Schooner "Monitor," Capt. John McKay, in the fresh halibut fishery stocked $18,986.67, the crew sharing $409.89.

The high line of the fresh halibut fleet is the schooner "Mooween" of Duxbury, commanded by Capt. Daniel McDonald of this city. The "Mooween's" stock for 1908 was in the neighborhood of $24,000, the share of the crew being $593.

In the Georges halibut fishery the schooner "Kineo," Capt. John G. Stream, is again the high liner, with a stock of $22,540.08 and a crew share of $564.32.

Other good stocks in this fishery last season were: —

Schooner "Niagara," Capt. Fred Thompson, $20,301.23 stock and $516.52 share.

Schooner "Teazer," Capt. Peter Dunsky, stocked $20,787.76, the crew sharing $506.61.

Schooner "Paragon," Capt. William Hermon, stocked $19,818, the crew sharing $428.75.

In the flitched halibut fleet the highliner was the schooner "S. P. Willard," Capt. Augustus Peterson, with a stock of $11,857.12, the crew sharing $298.83.

Other good stocks in this branch of the fishery were: —

Schooner "Fannie A. Smith," Capt. Joseph V. Bonia, $10,849.74 stock and $253.96 share.

Schooner "Admiral Dewey," Capt. James Hayes, $9,013.17 stock and $227.26 share.

The high line of the straight Georges handline fleet was the schooner "W. H. Moody," Capt. Andrew Gorveneau, with a stock of $9,932.33, the crew's average share being $257.12.

The high line of the "drift" or Rips salt cod fishing fleet was the schooner "Voland," Capt. Allen Doleman, with a stock of $13,401.65, the average share of the crew being $373.85.

Other vessels making good stocks and good shares in this branch of the fishery were: —

Schooner "Jubilee," Capt. Oscar Lyons, $12,078.32 stock and an average crew share of $339.21.

Schooner "Norman Fisher," Capt. John Williams, $10,463.44 stock.

The schooner "Etta Mildred," Capt. John Swim, has a stock of about $8,000, and with a fair catch on the trip upon which she is now absent she will be up among the leaders.

The high line of the haddock and shack fleet from this port is the schooner "Thomas S. Gorton," Capt. William H. Thomas, with a stock of $31,190.68.

Of the market boat fleet, the high liner is the schooner "Mary E. Cooney," Capt. Frank Cooney, with a stock of $34,000 and a crew share of the splendid sum of $1,115.

Edible and Bait Mollusks.

Dr. George W. Field, *Chairman, Massachusetts Department of Fisheries and Game, Boston, Mass.*

Dear Sir: — I respectfully submit the following report of the shellfish investigations for the year 1908.

The work of the biological staff of the Fish and Game Commission during the past season has been largely devoted to the study of the marine life of our coast. While considerable attention has been given to the relation of the various forms of sea life to the commercial fisheries, the main object of the work has been an investigation of the edible shellfish common in our tidal waters. This has been rendered necessary by the fact that the natural supply of shellfish, overtaxed by the exhaustive demands of the market, is fast diminishing, and unless the proper remedy is speedily imposed will soon reach the point of commercial extinction. Investigators who have been engaged in this type of work for years, and have a thorough knowledge of the prevailing conditions, believe that under a system of shellfish culture a far greater production can be brought about by the aid of man than can ever result under natural agencies. To this end many of the experiments of the past summer were directed, with the result that a practical solution of this important question has been presented in another report.

Reports. — In addition to this report, which covers in a general way the work of the past year, several pamphlets, dealing in a more specific manner with some of the important problems relating to the shellfisheries, are in preparation. It is the aim of these reports to present in concise form the mass of material accumulated in four years' study of the life history and habits of the edible shellfish. The essential object of these experiments, as clearly demonstrated in the reports, has been to provide practical methods for checking the waste of our natural resources and for building up the shellfish industries of the Commonwealth. Inasmuch as the work in question was undertaken for public benefit, and since its fulfillment in a great measure depends upon presenting this knowledge to the people at large, it follows that all the good which might properly result from these labors will be lost if this information is not widely disseminated. It is therefore necessary that ample appropriations be made whereby

these reports can be placed in the hands of every man in whose interests these experiments were undertaken and for whose benefit these papers were designed.

Assistants. — Two permanent assistants were appointed in 1908 to the biological investigation staff. Previous to this time the department of research had been conducted by the biologist, with temporary assistants during the summer months. F. C. Lane, A.B., of Boston University, was appointed assistant biologist, and Mr. Alvah A. Perkins was engaged as assistant. Prof. William G. Vinal of Marshall College was engaged as scientific assistant during the summer. The work of all the assistants was of the highest order and deserving of commendation.

Courtesies. — The commission wishes to express its deep appreciation to Mr. L. D. Baker of Wellfleet for providing suitable laboratory facilities, as well as for many other courtesies. Acknowledgment is also made to Capt. Z. A. Howes of Wellfleet for many valuable suggestions, as well as to the oystermen and quahaugers of Wellfleet for their hearty co-operation and courteous treatment. At Plymouth the commission is indebted to Mr. Frank F. Cole for his kindly oversight of the experimental clam beds.

Location of the Work in 1908. — While still continuing the work at the Monomoy Point laboratory and on the various experimental plots for studying the growth of mollusks along the coast, central headquarters were established for the summer at Wellfleet, which offered abundant opportunities for shellfish investigation. As an important part of the 1908 work consisted in the study of the spawning, life history and growth of the quahaug, it seemed desirable to locate at this place, which has long enjoyed the distinction of being the foremost quahaug fishing town in the State, and whose spacious bay possessed a variety of natural conditions favorable for the investigation of this important shellfish.

The Laboratory at Wellfleet. — Through the kindness of Mr. L. D. Baker the commission was given, free of expense, the privilege of occupying one of the buildings on Commercial Wharf. The largest of the three rooms, an apartment of some 30 by 20 feet, was converted into an excellent laboratory by the erection of suitable tables and benches for microscopy, while the central part of the room was given up to a series of tanks, hatching jars and aquaria, which were supplied with running salt water through a system of galvanized-iron pipes. The laboratory was further equipped with a stove and a sink supplied with running fresh water. In one corner a small office 8 by 10 feet was partitioned off, affording space for desk, filing systems, etc. Adjoining the laboratory were two smaller rooms, which furnished sleeping accommodations for four persons.

Conditions at Wellfleet. — Wellfleet Bay, a body of water some five miles long, fed by three large creeks, offers many interesting problems

in shellfish culture and presents a variety of conditions especially favorable for experimental work. A striking feature is the great difference in tides, the mean rise and fall being over 10 feet, which leaves at low water a large area of tidal flats, in some instances extending over a mile from shore. These flats, except for razor clams and a few scattering quahaugs, are practically devoid of shellfish life. The soft clam is found in only a few localities and nowhere to render digging extremely profitable. On the edges of the flats and in the channels extending far out into deep water quahaugs are found in large, though fast-diminishing quantities. Here in the deep water an extensive quahaug fishery is carried on by the aid of long-handled rakes manipulated from power or sail boats. In the more quiet waters are many oyster grants, which support a prosperous business, while scallops are occasionally found on the flats, but rarely in sufficient quantities to render their capture profitable.

Work at Wellfleet. — The work at Wellfleet during the past year consisted for the most part in a general study of the life history, growth and habits of the quahaug, clam and oyster, an investigation of the food of the edible shellfish, and various minor experiments on the scallop and other forms of marine life. In order to give a comprehensive account of the work it will be necessary to deal with each shellfish separately.

(*a*) *The Oyster.* — The main problem which presents itself in dealing with the oyster was a purely practical one, namely, a study of the causes influencing the set in Wellfleet harbor. For years this problem had completely baffled the local oystermen, and many of the planters maintained that the harbor was utterly unadapted for the capture of oyster spat. All were enthusiastic in wishing success to the investigations and co-operating with us in the work. While all the causes influencing oyster set may never be determined, even a partial solution of the difficulty, so as to enable the grower to control the set even to the slightest extent, would be worth thousands of dollars to this community.

In order to attack the problem in as effective a manner as possible in the limited time at our disposal we first made a comprehensive reconnaissance of the harbor to familiarize ourselves with its physical features, such as the configuration of the coast line, the formation of sand bars and flats at low tide, the various currents and eddies, registering their velocity at different times of tide in the apparently favorable localities. While this work was carried on in conjunction with the experiments on quahaugs, as only part of the time could be given to it, we were able in a general way to pick out, from our knowledge of the case as well as from the past experience of the local oystermen, the precise localities where the spat would be most likely to set. Meanwhile, by keeping careful note of the spawning of the oysters in the bay, both by microscopical examination of the oyster

itself and the floating larvæ, taken by means of tow nets of silk bolting cloth, we were able to time our future experiments accordingly. When the ripeness of the spawn and the prevalence of the small fry in the water indicated that the young oysters were ready to set, a series of spat collectors, seventy in number, was immediately put down in the localities most favorable for set. The particular type of collector which seems best adapted to the requirements of the case is simple in construction, consisting of a small heap of shells covered with a strip of galvanized wire netting held in place by stakes at each corner. It was necessary to cover the shells with the wire netting to prevent them from being washed away by the strong currents and scattered over the flats. The results from the use of these collectors were highly successful. Though some were washed completely away and others buried in sand and slime, the practicability of catching oyster spat on a commercial scale in Wellfleet harbor was demonstrated.

In completing the results of our investigations along this line we did not confine our observations to the spat collectors alone but took careful note of the set wherever found on rocks, stakes, shells, etc., along the shore. In this manner the entire set area of the harbor was mapped out in such a way as to show its relative abundance. It is only through observations of this character carried on for a series of years that anything definite will ever be learned of this important problem, and this is but the first step in the Wellfleet problem.

From the work briefly outlined above, as well as from other experiments in the laboratory, fairly accurate conclusions were worked out as to the following points: duration of the spawning season at Wellfleet, areas best adapted for catching set, factors influencing the set, and possibilities of commercial spat collecting. Of course no records covering but a single year, however accurate, can be considered reliable, and it will be necessary to supplement the experiments already made with others in the future before final results are obtainable.

(*b*) *The Quahaug.* — The biological survey of 1907 brought out very clearly the important fact that the quahaug industry of the State, worth nearly $200,000 a year, is seriously threatened by the extinction of the natural supply unless some radical remedy is soon applied. As the result of cultural experiments conducted for the past three years the Fish and Game Commission has advocated putting the quahaug industry on a basis similar to that of the oyster industry, *i.e.*, upon a system of grants leased to private individuals who shall depend to a greater or less extent upon the cultivation of quahaugs for a livelihood. It is not our purpose to discuss this system at any length here. We have already done so in other reports and will continue to do so from time to time. Neither do we advocate in any sense the system of oyster culture of the present day as applying to quahaug

culture, as there are many defects in the former system which should be done away with.

The question of "seed" raises a fundamental difference between quahaug and oyster culture. While it is possible to purchase oyster "seed" in large quantities, it is practically impossible to purchase any quahaug "seed" at all. The capture or raising of small quahaugs, entirely unlike that of the oyster, has never been successfully carried out on a large scale. It follows, then, that however necessary to the welfare of the quahaug industry in this State the inauguration of grants would be, such a system must inevitably fail of complete success unless some practical method can be devised for obtaining large quantities of the "seed." The solution of this problem proved an extremely difficult undertaking, and the result of the summer's work was in many regards extremely unsatisfactory. Knowing that an adult quahaug yields several million eggs in one season, and that under natural conditions most of these perish, we attempted to assist nature at her weakest point of resistance, and accordingly tried hatching experiments both in and out of the laboratory by artificial and natural fertilization, with the aim of confining the young larvæ in aquaria and spawning ponds until they attained adult size. These experiments, though productive of much practical experience, failed of their main object, partly through necessary pioneer's mistakes in conducting the work, but mainly through lack of sufficient facilities and by reason that the work did not start until the spawning season was well under way. Under such disadvantageous conditions we do not feel discouraged with the somewhat meager results in this branch of our work. We have learned many things that should prove of material assistance in future endeavors along this line, and the mistakes of the past season need not be repeated. The results of this work have given us considerable information concerning the spawning season and many important points in the early life of the quahaug.

Further experiments on the growth of the quahaug and along the line of quahaug culture were made by planting nearly two hundred small beds along the shores of the harbor, for almost nine miles, under great diversity of environment. Our object was to determine what effect such conditions as current, soil, depth of water, time of exposure, salinity of water, shifting sand, etc., would have on the growth of different-sized quahaugs. In order to properly identify and accurately determine the rate of growth all planted quahaugs were notched with a file, which readily indicates the amount of growth when taken up. In this simple manner we were able to arrive at some interesting conclusions and to compile some useful facts for future reference. Although several of the beds were washed away by strong tides, or buried by shifting sand, the greater part of them gave very gratifying results and were an unqualified success.

(*c*) *The Clam.* — While the main work of the year was in reference to the quahaug and oyster, some attention was given to completing the work on the clam, which had been extensively studied the two previous years. The chief part of this work was the study of the effect of different soils and locations on the growth of the clam, for which purpose about sixty beds were planted in the harbor. Difficulty was first found in procuring a sufficient quantity of seed clams, which were finally procured at Ipswich. The planted clam beds, all on barren flats, did not do particularly well, as shifting sand and cockles destroyed most of them. A few furnished satisfactory records for the amount of time devoted to this work. Wellfleet's barren flats are in part productive, and the causes which prevent restocking furnish abundant material for future experimental work.

(*d*) *The Scallop.* — The work on the scallop was confined to clearing up several points in the life history of the animal, and confirming the work of the previous year. For this purpose scallops were brought from Chatham to Wellfleet and kept in wire baskets near the laboratory.

The Biological Survey. — In connection with our experimental work it was a matter of the utmost importance that we have a thorough knowledge of the physical characteristics of Wellfleet Bay, which furnished the field for most of our experiments. It was necessary to learn as much as possible of the natural environment and physical features which influenced the results of our experiments. A well-grounded knowledge of the bay, its tides, currents, eddies, bars, rocks, characteristic soil and various living animals, was of great value in carrying out experiments such as the observations on the formation of oyster set. In this way a fairly complete record of the tidal flats and to some extent the deeper waters of the harbor was kept by means of maps ruled into squares and subsquares, which enabled us to locate exactly the site of any particular experiment and to keep accurate records of the different flats. This same system was also found to be of great use in our work along the Massachusetts coast.

Shellfish Food — Water Analysis. — Observations upon the supply of shellfish food in the sea water at Wellfleet were begun the first of the season. Methods were used whereby the amount of food, which chiefly consists of microscopic plants called diatoms, could be counted in a sample of water with but slight error. By taking a large number of samples in different localities from the water over the shellfish beds it was intended to deduce, if possible, some important facts about the food supply in Massachusetts waters. Eight representative localities were chosen in the bay, and samples taken from these as often as circumstances would permit. For uniformity, the water samples were taken at half tide, with a cylindrical brass cup designed for similar work by Dr. H. F. Moore of the United States Bureau of Fisheries. Observations on the time of tide, direction and force of wind, depth, temperature and salinity of the water, and velocity of current were

made at the time of taking. In spite of considerable work in this line we feel that we have made little more than a beginning. Through the co-operation of the United States Bureau of Fisheries we have been able to greatly improve our system, and next season hope to continue our investigations on a much larger scale.

Work at Monomoy Point. — The laboratory at the Powder Hole, Monomoy Point, was run in connection with the main laboratory at Wellfleet, and although no one was stationed there, frequent visits were made at definite intervals during the summer for the purpose of recording experimental data. As in previous years, the raft, from which were suspended the spat collectors and the growth boxes, was moored in the central part of the Powder Hole on June 15 and taken up November 10, completing three years of growth for the clams and quahaugs which were in the boxes.

(*a*) *Clams.* — Several beds in the Powder Hole flat planted in 1905 were taken up, the clams measured, filed and replanted. Various box experiments for growth were conducted on the raft. Data on the amount of spat caught in the collectors were recorded, while detailed observations were made on the effect on the growth of clams of certain physical changes in the flat.

(*b*) *Quahaugs.* — The growth experiments of the previous years were continued both on the flats and in the raft boxes, completing three years' continuous record on the growth of the quahaug in this locality. Records of the spawning and the set were made, as shown by the spat caught in the box collectors on the raft.

(*c*) *Oysters.* — The growth experiments in regard to certain points of practical interest were continued by means of planted beds.

(*d*) *Scallops.* — For the third consecutive year observations were made concerning the length of life and growth of the scallop, which confirm the results of the past two seasons. It is, perhaps, of special interest in this connection to show what can be done by the proper transplanting of scallops for the purpose of increasing the future supply in any locality. In the fall of 1906 the commission transplanted from the common flats of Chatham about fifty bushels of "seed" scallops to the Powder Hole. The following summer these spawned, with the result that there was an enormous set of scallops, so thick in the spring of 1908 that a person wading in the water could hardly step without crushing one. Such a heavy set had never before been known in the Powder Hole and undoubtedly was due to the importation of the "spawners."

Coast Work. — Records and observations were made on the clam growth experiments on the flats of Kingston, started by J. R. Stevenson in 1906.

Growth and cultural experiments on the clam in the Essex and Ipswich rivers and in Plum Island Sound were continued.

Growth experiments on clams and quahaugs were started at Barnstable and a partial survey of the flats was made.

Educational Work. — The importance of popularizing and of bringing the results of the investigations on the mollusk fisheries to the attention of the public, and particularly the fishermen, has been realized by the Fish and Game Commission, and in addition to the scientific work it has undertaken this work in three ways.

(1) *Exhibits at Fairs.* — Exhibits, illustrating the life histories, growth and habits of the food mollusks, have been made at several county fairs, particularly along the seacoast. In these exhibits it has been the aim of the commission to present to the public practical illustrations of the financial returns and profits resulting from a system of under-water cultivation, such as is advocated by the commission. Exhibits were made at the Boston Food Fair, Lynn Horticultural Society Exhibit, Greenfield Fair, Great Barrington Fair and Barnstable County Fair, and in every instance were a source of great interest. Another year it is hoped to extend the scope of these exhibits, especially in the central and western part of the State, in order to bring before the public the practical side of the sea fisheries.

(2) *School Exhibits.* — Several requests from schools in different parts of the State for museum specimens and displays illustrating the life and habits of the different mollusks have been made of the commission, and practically all these requests have been complied with. These displays are designed to facilitate the study of nature and sea life, and at the same time develop an interest among the future men and women of this Commonwealth in the conservation of not alone the shellfisheries, but of all the natural resources of the nation.

(3) *Lectures.* — A most popular method of dispersing knowledge concerning the shellfisheries, especially along the seacoast, has been by illustrated lectures before the fishermen of the different towns. In this way the importance of preserving the great wealth of the ocean and the value of the tidal waters of Massachusetts has been brought clearly before the inhabitants of the coast towns. It is hoped that an extensive series of lectures can be given another year in the coast towns.

Investigation not Hatching. — Ever since the commission has been conducting scientific investigations on the mollusks it has been difficult to make people, particularly those in the coast towns, understand the exact nature of the work and its usefulness. The fishermen expect to see the barren flats at once completely stocked with millions of clams, and they are disappointed when nothing was done on so large a scale. They do not consider that such work would demand appropriations a hundred or even a thousand times as great as the small amounts that are given for the preliminary investigation which must precede any hatchery work. It is the investigator's duty to discover the ways and means; that of the hatchery, to put such into practical

execution. The commission can only point out the methods to be employed by those responsible for the successful maintenance of the fisheries.

The Fish and Game Commission v. *the Fisherman.* — In conclusion it seems advisable to attempt a correction of the mistaken opinions prevalent in some quarters regarding the purpose and value of the experimental work of the Fish and Game Commission. Among the hardy fishing communities of our coasts, inhabited for the most part by men accustomed to dealing with things in a solely practical way, there is perhaps quite logically a tendency to underrate the importance of all scientific research. There is also on the part of many of these worthy people a primitive caution, which leads them to distrust the motives of strangers, and particularly of scientific men. It is gratifying to be able to state that this atmosphere of distrust is in great measure wearing away with the progress of time. The people of our coast communities are becoming educated to the value of scientific investigation; they are beginning to see that the government is the trustworthy friend of the common people, and that the commission is working to help them; and they are becoming more and more awake to the fact that the experiments conducted both by State and federal authorities are furnishing them much information of practical value which could be obtained in no other way. With the better establishment of this feeling of mutual understanding and good will, the work of this department cannot fail to be materially improved. When the fisherman joins his practical experience, attained through long years of observation, to that of the scientist, skilled not alone in observation but careful in the interpretation of these observations, both may work with far greater advantage to the benefit of the fishing interests of the Commonwealth.

D. L. Belding, *Biologist.*

The Lobster Problem. — The unwise method of dealing with the lobster still continues, partly as a result of "log rolling," and partly as a result of a misconception on the part of many legislators who understood that in voting for the 9-inch bill (chapter 303, Acts of 1907) they were carrying out the recommendations of the commission, when as a matter of fact they were voting for only a part, and for a part which, shorn of the saving restrictions relative to the taking of all adults above 11 inches, is the most unwise and destructive legislation which can be conceived, and a mistaken provision, which has been chiefly responsible for the decline of the lobster supply from Massachusetts waters. It must be noted that instead, as formerly, of sending lobster smacks to the New York market from Province-

town as well as supplying our own local markets, less than 5 per cent. of the mere local supply now comes from Massachusetts waters. The ratio of decline is indicated in the following figures: —

Year.	Men.	Traps.	Lobsters.	Average per Pot.	Egg Lobsters.	Ratio of Egg-bearing Lobsters to Total Catch.
1890, . . .	479	19,544	1,612,129	82	70,907	1:22
1906, . . .	335	21,918	487,332	22	9,378	1:52
1907,[1] . . .	379	21,342	1,039,886	49	10,348	1:100
1908, . . .	349	19,294	1,035,123	54	9,081	1:115

[1] The increase in numbers resulted from a change in the law permitting the catch of lobsters down to 9 inches in length.

The chairman of this commission has persistently and consistently urged the logical advantages of using only the lobsters between 9 and 11 inches long for food, for the following reasons: —

(1) The public can from such lobsters secure cheaper lobster meat, even if the price of large and of "chicken" lobster is identical; *e.g.*, on a basis of 20 cents per pound in the shell, boiled, lobster meat costs the consumer approximately 90 cents per pound if taken from large lobsters, as compared with less than 70 cents per pound if taken from lobsters from 9 to 11 inches long.

(2) The meat of the small lobsters is of better quality for eating.

(3) The small lobsters live longer in transportation, and are more easily handled for marketing.

(4) By protecting the lobsters which have reached the breeding age, a larger number of eggs would be produced annually. The larger lobsters are the most prolific breeders, and are practically secure from all enemies except man.

(5) In dealing with all other animals which are of value as food for man, protection to the animals of breeding age has proved to be necessary (*e.g.*, cattle, poultry, etc.), while a certain number of the young animals are used as food. If the supply of young animals is insufficient, more adults are kept

for breeding. This is a logical biological practice, necessitated by natural laws, and must ultimately be applied to the lobster problem.

(6) A law protecting the adults of both sexes above 11 inches long could be readily enforced by forbidding the use of lobster pots having an entrance ring greater than 3¼ inches, inside diameter. The lobster fishermen on the north coast of Prince Edward Island have applied this principle, with most satisfactory results. This automatic protection of the adults of breeding age has resulted in a greatly increased number of lobsters below 11 inches, which ensures a supply best suited to local demands, and increasing returns to the fishermen of that region.

(7) Such a law would combine all the advantages of (*a*) a close season (but without limiting the supply or seriously interfering with local market conditions), by essentially making a close season for all lobsters of breeding age, and of (*b*) the restrictions imposed by the lower-size limit, intended to check the use of lobsters too small to be of economic value for market. Present laws place a premium upon the destruction of the breeders, for the vast majority of lobsters placed upon the market to-day from Massachusetts waters have not reached the breeding age, or at best have produced in their lifetime less than 20,000 eggs, instead of upwards of 1,000,000 eggs per lobster, which nature has found necessary for the maintenance of this species. That such a practice does not quickly result in complete commercial extinction is due solely to the size of the area inhabited by lobsters, and the difficulties encountered by the fishermen. But the results already evident in the immediate neighborhood of the great markets, *i.e.,* the waters of New Jersey, New York, Connecticut, Rhode Island and Massachusetts, will gradually extend farther north, though doubtless obscured for many years by the specially favorable character of the coasts of Maine, Nova Scotia and Cape Breton for lobster growing, and by the development of practical artificial methods for checking the natural destruction of newly hatched lobsterlings, and rearing these on a commercial scale. But the efficiency even of such practice is directly dependent upon an adequate supply of eggs from the

very best types of mature breeding animals, whereas under present laws we are relentlessly seeking out for destruction the best and largest breeders (together with the immature breeders 9 to 11 inches long), instead of reserving them for maintaining the supply of young.

The fallacious argument that the destruction of lobsters of breeding age is justified by the fact that a 9-inch lobster on the next moult (which may occur within a few hours, or at most within a few months) becomes a $10\frac{1}{2}$-inch lobster, worth much more money in the market, is as logical as to kill the best breeding hens or cows because they are worth more money than one which is about to attain the breeding age. To be in exact accord with facts, the fishermen, the dealers and the public should be made to realize that with similar rapidity the class of protected breeders above 11 inches (upon which alone the future supply must depend) would be recruited from the 9 to 11 inch class. The writer has said that one 11-inch lobster is worth for the maintenance of the fishery at least five 9-inch lobsters, but Dr. Herrick states the biological value of the adult in much stronger terms by saying that "in the twelve years" following the beginning of the reproductive age, when the lobster grows from a 9-inch lobster to a 15 or 16-inch animal, the value of one lobster "to the fishery has been increased 800 per cent." There is abundant evidence that there would be a very considerable and probably sufficient number of smaller lobsters which would at one moult pass into the exempt class, and thus become increasingly efficient breeders for the succeeding fifteen to thirty years. The all-important biological fact is that, whereas under the present law every lobster above 9 inches is exposed to capture throughout its life (possibly thirty to forty years), under the suggested law a lobster would be thus exposed during only a relatively brief space (not exceeding two years). There is no question that such efficient protection to the source of the lobster supply and adequate regulation of the fisheries would work hardship to many worthy fishermen, even to driving many out of business. Yet many worthy persons who formerly shot game and song birds or caught trout for market purposes have, as a result of wise and necessary restrictive laws, experi-

enced a somewhat similar deprivation, for the immediate benefit of the public and the ultimate advantage of every individual.

The noteworthy paper by Professor Herrick, presented Nov. 24, 1908, at the recent Conference of the Governors of the New England States, held at Boston, is reprinted for the purpose of ensuring a wider audience to the careful statements of highest authority from the foremost student of the lobster in the world: —

The Preservation and Propagation of the Lobster.

By Dr. Francis H. Herrick, Special Investigator, United States Bureau of Fisheries, Professor of Biology, Adelbert College, Western Reserve University, Cleveland, Ohio.

The problem of preserving or restoring a natural food supply of a nation is sufficiently difficult in itself, though supported by all the knowledge which natural science can supply. If the supporting arm of science is necessary, the co-operation of the people is equally indispensable. Where, as in the present case, the interests of at least five sovereign States are materially involved, how much more difficult do such questions become; and without co-operation how impossible of solution. My first word is therefore one of congratulation to Governor Guild and to all who are responsible for this conference of States. It is the consummation of the desires of every thoughtful citizen and worker in the field and laboratory for the past twenty years. Whether entire agreement can now be reached upon every question, or not, all must agree that the right step has been taken, and we may look to the future for reports of progress that is real, if not for immediate success.

The lobster is easily the king of the crustacean class, and, though neither fish, flesh, fowl nor good red herring, he is excellent eating, and that his tribe may increase is a wish generally felt and often expressed.[1] Unfortunately, for many years past we have watched this race decline, until the goal of commercial extinction, not far remote in the future, seems to await the entire fishery. What is the matter with the lobster?

[1] While the public seems to demand the lobster in ever-increasing quantities, some diversity of opinion naturally occurs. Thus one person recently wrote that he must have at least one lobster a week, no matter what the price; while another expressed the fervent wish that this animal might be exterminated, — wiped completely off the map, — since it had given him so many hours of sorrow and repentance. Such expressions as the last, however, have their brighter side when we reflect upon the diminishing supplies now reaching the markets in many places.

Let us glance very briefly into economic and zoölogical history, before trying to find the right answer. The lobster has attracted many naturalists and other observers, both in this country and in Europe, especially during the past fifteen years, until it has become the focus of a wide literature, and few marine animals are now so well known. The main biological facts concerning this classical type are well in hand, and excuse can no longer be offered on the ground of ignorance.

White men caught lobsters in Massachusetts Bay for the first time early in the seventeenth century. The Pilgrims and Englishmen who began to flock into the bay colony about the year 1630 were well acquainted with the products of the sea in their old home, and the coast of New England supplied their tables with essentially the same kinds, only in far greater abundance. It is said, indeed, that the Pilgrims began at once to pay their debts, due in England, out of the products of their fisheries.

In the chronicles of those early days the lobster is honored with frequent mention, and the early colonists must have enjoyed to the full both the new and the familiar kinds of American fish, lobsters, crabs and clams, so big, so palatable, so abundant, and so cheap everywhere along this coast. Indeed, one would think there was no need of starvation, with lobsters and the other forms of sea food to be had on every shore. To quote from Mrs. Earle,[1] the minister, Higginson, writing of Salem lobsters, said that many weighed twenty-five pounds apiece, and that "the least boy in the plantation may catch and eat what he will of them." Again, in 1623, when the ship "Anne" brought over many of the families of the earlier Pilgrims, the only feast of welcome which the latter had to offer was a "lobster or a piece of fish without bread or anything else but a cup of spring water."

The Pilgrim lobsters "five or six feet long," ascribed to New York Bay, take us back one hundred years farther, to the time of Olaus Magnus, who wrote that in the Orkneys and the Hebrides these animals were so huge that they could catch a strong swimmer and squeeze him to death in their claws. At this point it will be interesting to observe that in a tabulated list of some fourteen of the biggest lobsters ever captured on the Atlantic coast, and for which authentic weights or measurements have been preserved, the giant among them all weighed 34 pounds, and measured exactly $23\frac{3}{4}$ inches from spine to tail. All of them are males, and this one was caught off the Atlantic Highlands, New Jersey, in 1897, was kept for a time alive at the Aquarium in New York, and its skeleton may now be seen at the American Museum of Natural History in that city. No doubt the Pilgrims would measure a lobster as some fishermen do now, with the big claws stretched to their fullest extent in front of the head. In

[1] Earle, Alice Morse: "Home Life in Colonial Days," p. 117. New York, 1898.

this condition the actual length of the animal is about doubled, so that the length of our New Jersey record breaker, when distended in this way, would reach nearly four feet, and the Pilgrim six-foot lobsters have been stretched at least two.

In an account of marketing in Boston in 1740 "oysters and lobsters" are mentioned "in course the latter in large size at 3 halfpence each," and this abundance continued for over one hundred years.

To revert at once to modern times, it is not necessary to dwell upon the increase in price to the consumer which has followed the decrease in the supply of this animal. Many no doubt remember when lobsters were sold by the piece, and at a few pennies at that. Five years ago, with a market price of 25 cents per pound, a lobster weighing 3 pounds 9¼ ounces cost, at an inland market in New Hampshire, 90 cents. The clear meat of the claws and tail of this animal, which had a fairly hard shell, were found to constitute but 27 per cent. of the whole. This would bring the cost of such meat to 90 cents per pound. Even when every edible part of this animal was saved, which is seldom or never done, the total waste was found to be 45 per cent., and the cost of all edible parts 45 cents per pound. At the present retail prices of from 30 to 35 cents per pound, these estimates would have to be considerably increased.

According to Mr. Richard Rathbun,[1] who was the first to give us a history of the American lobster fisheries, this fishery as a separate industry began towards the close of the eighteenth or the beginning of the nineteenth century, and was first developed on the coast of Massachusetts and in the region of Cape Cod and Boston, some fishing being "done as early as 1810 among the Elizabeth Islands and on the coast of Connecticut." "Strangely enough, this industry was not extended to the coast of Maine, where it subsequently attained its greatest proportions, until about 1840."

The early white men learned many lessons in fishing from the Indians, and doubtless those living upon the coast in the course of time began to supply others more remote, until the Cape Cod region, having become famous, attracted fishermen with their smacks from Connecticut and from other States, and supplied most of the lobsters consumed both in Boston and New York for fifty years, or until the middle of the nineteenth century. As early as 1812, as Mr. Rathbun remarks, the citizens of Provincetown, realizing the danger of exhausting their fishing grounds, succeeded in having a protective law enacted through the State Legislature, apparently the first but not the last of its kind, for legal restrictions, including this statute, have been in force ever since. But this measure was designed to protect the fishermen rather than the lobster, for it was merely declared illegal

[1] "The Fisheries and Fishery Industries of the United States," Vol. II., sect. v, part xxi. Washington, 1887.

for any one not a resident of the Commonwealth to take lobsters from Provincetown without a permit. The laws later enacted proved of little or no avail; by 1880 the period of prosperity had long passed, and few lobsters were then taken from the Cape. Only eight decrepit men were then engaged in the business, and were earning about $60 apiece. This great local fishery was thus rapidly exhausted by over-fishing, and it has never recuperated.

The history at Cape Cod has been repeated on one and another section of the coast, from Delaware to Maine, and is already well advanced in the greatest lobster fishing grounds of the world, the ocean and gulf coasts of the British Maritime Provinces of Canada, especially of New Brunswick and Nova Scotia, and in Newfoundland.

Every local fishery has either passed through, or is now passing through, the following stages: —

1. Period of plenty: lobsters large, abundant, cheap; traps and fishermen few.

2. Period of rapid extension: beginning in Canada about 1870, and much earlier in the older fishing regions of New England; greater supplies each year to meet a growing demand; lobsters in fair size and of moderate price.

3. Period of real decline, though often interpreted as one of increase: fluctuating yield, with tendency to decline, to prevent which we find a rapid extension of areas fished, multiplication of fishermen, traps and fishing gear or apparatus of all kinds; decrease in size of all lobsters caught, and consequently of those bearing eggs; steadily increasing prices.

4. General decrease all along the line, except in price to the consumer, and possibly in that paid the fisherman.

The official statistics for this State and for Canada afford pertinent illustrations of the older and newer phases of this history. Thus, in Massachusetts in 1890, 373 fishermen, working 19,554 traps, caught 1,612,129 lobsters of legal size and 70,909 egg-bearing females, with an average catch per pot of 82. Fifteen years later it required 287 fishermen, working 13,829 traps, to produce about one-quarter the number of lobsters, or 426,471, and less than one-seventh the number of egg-bearing lobsters, or 9,865; while the catch per trap had diminished by nearly two-thirds, and was only 31. No substantial increase followed until 1907, when the legal length was reduced to 9 inches, and this increase was undoubtedly due to the large number of small lobsters caught.

The lobster fisheries of Canada, which next to those of the codfish and salmon are most valuable to the Dominion, have yielded from 1869 to 1906 inclusive, a period of thirty-seven years, a grand total of $83,291,553. In 1897 the produce of this fishery was 23,721,554 pounds, valued at $3,485,265. Ten years later, in 1906, the yield had dropped to 10,132,000 pounds, but, though less than one-half as great,

it had nearly the same value, namely, $3,422,927. Notwithstanding the increased cost to the consumer, even in Canada the total value of the fishery has begun to fall, the product for 1906 being less by half a million dollars than that of 1905.

The lobster grounds of the Atlantic coast were the finest the world has ever produced, a field, according to one estimate, 7,000 miles in length, when measured along the curve of the shores, and extending full 1,300 miles in a straight line from Delaware to Labrador, with a width reaching out to 50 miles or more from the coast. In Canada alone 100,000,000 lobsters have been captured in a single year.

If properly dealt with, it would seem as if this vast natural preserve should have yielded lobsters in abundance and in fair size for generations and even centuries to come. But instead, lean and still leaner years soon followed those of plenty, first in the older and more accessible regions of the fishery, until the decline, which has been watched for more than three decades, has extended to practically every part of this vast area.

The lobster fisheries of the old world, and especially the more important industries of Norway and Great Britain, when they came to be pursued with the system and energy characteristic of modern conditions, have experienced a similar decline, and upon the whole attempts have been made to meet it in a similar way and with the same result. The treatment has been of the symptomatic kind, and the real cause of the difficulty has not been reached. Sweden, indeed, is said to have felt the need of protective measures two hundred years ago, and to have framed the first laws regulating her lobster fishery in 1686. In 1865 the export of lobsters from Norway, to England chiefly, reached nearly 2,000,000 in numbers. Already as early as 1838 protective measures were being vigorously discussed, and it was proposed to establish a gauge-limit of 8 inches; but this was rejected, and a close season (July 15 to September 30, and later extended from July to November) adopted instead. From 1883 to 1887 about 1,000,000 lobsters were captured on the Norwegian coast yearly, having a value of 640,000 francs ($128,000), a large part of the product being consumed in the interior, and the rest exported alive.[1] While this small fishery has maintained itself better than most, it has probably suffered still greater reduction in recent years, but at this moment the later statistics are not available.

The yield of the lobster fisheries in the British Islands has in some years reached a total of 3,000,000 lobsters, and complaints of a diminishing supply have been loud and frequent. This would be a little over a third more than the returns of the Massachusetts fishery in 1888, with its higher gauge of 10½ inches at that time.

What means have been adopted here and in other parts to check

[1] "Les Pêcheries de la Norvége," Exposition Universelle de 1889 à Paris. Bergen, 1889.

the decline of this fishery, so general and so universally acknowledged? The more important restrictive measures enacted at sundry times and in divers places have been as follows: (1) Closed seasons, of various periods in different localities. (2) The legal gauge or length limit; namely: 9 inches in New York, Rhode Island and Connecticut; 10½ inches in Maine and New Hampshire, and in Massachusetts until reduced to 9 inches in 1907; 8 inches in Norway and England; and 8, 9 and 10½ inches in different districts of Canada; in all cases penalizing the capture and sale of all lobsters under these limits, and legalizing the destruction of all adults above the gauge. (3) "Egg-lobster" laws, or the prohibition of the destruction of female lobsters carrying their external eggs. In addition to such legislative enactments, efforts of a constructive character have been made as follows: (4) To increase the supply of lobsters in the sea by fry or larvæ artificially hatched and immediately liberated, and, as practised chiefly in Canada, by holding the berried lobsters in large enclosures, called lobster pounds, ponds, preserves or parks, and subsequently setting them free when the young are ready to hatch. (5) By the rearing method lately being introduced of holding the fry artificially hatched, and rearing them until the fourth or fifth stages, when they go to the bottom, and are able to take care of themselves. We cannot at present enter into other legislative channels, such as laws prohibiting the sale of broken or picked-out lobster meat, the operation of canneries, or the construction of gear, however necessary they may be for this fishery. We must devote our attention to those subjects of most vital concern to the fisheries as a whole.

The most important things to consider first are: (2) the legal length limit; and (4) the hatching and immediate liberation of the young, because they are fundamentally related, have been long on trial, and have entailed great expense. That they have had a fair trial and that they have signally failed all must admit.

No doubt there are many who are ready to affirm that the present laws would be good enough, if enforced. Most people are aware that the gauge law has not been rigidly carried out, and that the illegal sale of short lobsters has become a trade of big proportions. I know very well that at many times of the year it is possible to buy short lobsters (said to come from Baltimore) in the markets of Cleveland and of other towns in the great middle west, but nevertheless I cannot share this idea. Both of these measures were bound to fail, and would have failed whether the short lobsters were destroyed or not.

To come back to our question, What is the matter with the lobster, or with our means of fostering it? We have committed a series of grave errors in dealing with this fishery, to the chief of which, the gauge law, the others have been contributory.

First, by legalizing the capture of the large adult animals, above 10½ inches in length, we have destroyed the chief egg-producers, upon

which the race in this animal, as in every other, must depend. Second, as supporting or contributory causes, some of us now, like others in the past, have entertained false ideas upon the biology of this animal, especially (*a*) upon the value of the eggs or their rate of survival, that is, the ratio between the eggs and the adults which come from them, and (*b*) of the true significance to the fisheries of the breeding habits, especially in regard to the time and frequency of spawning and the fosterage or carriage of the eggs. Our practices have been neither logical nor consistent, for, while we have overestimated the amount of gold in the egg, we have killed the goose which lays it. We have thought the eggs so valuable that we have been to great trouble and expense in collecting and afterwards hatching them and committing the young to the mercy of the sea, while we have legalized the destruction of the great source of the eggs themselves, — the large producing adults.

This fundamental error of destroying the adult lobster was first clearly pointed out in 1902 by Dr. George W. Field,[1] chairman of the Commissioners on Fisheries and Game in Massachusetts, and who in various reports since has ably advocated a sounder policy, based both on science and common sense, as will appear later in this paper.

Our lobster fishery laws, which date in the main from 1873, are in principle like those which prevail elsewhere, and taken as a whole they illustrate the force of example and tradition, which were established long before the biology of this animal was even approximately understood. The past literature of this crustacean bristles everywhere with these false notions, which are more or less directly and mainly responsible for the enactment and maintenance of the present laws and practices of this fishery.

The legal length limits of 9 and 10½ inches, which sanction the destruction of the big egg-producers, but for these supporting causes, would probably never have been retained, for these causes have led to a diversion of energy in various directions, such as the enactment of closed seasons and the practice of hatching and immediate liberation of the fry.

A closed season for any animal, during which it is made illegal to hunt or fish for it, can only be completely justified and placed upon a scientific basis when it is made to correspond to the breeding season of the species as a whole, and when this season is limited to a relatively small part of the year. Neither of these things is possible in the lobster, since the question is complicated by the fact that this

[1] Field, George W.: "A Report upon the Scientific Basis of the Lobster Industry, the Apparent Causes of its Decline, and suggestions for improving the Lobster Laws." Report of the Commissioners on Fisheries and Game of Massachusetts for 1901. Boston: 1902. Also, "The Biological Basis of Legislation governing the Lobster Industry." Science, N. S., vol. xv. New York, 1902. "The Lobster Fisheries and the Causes of their Decline." Fortieth Annual Report of the Commissioners on Fisheries and Game of Massachusetts. Boston, 1906.

animal spawns but once in two years, so that not more than one-half of the adult females reproduce annually, and these eggs when laid are carried about by the lobsters through nearly an entire year. Closed seasons of this character are therefore not to be recommended, since they serve merely to restrict the total amount of fishing done in the year, and do not touch the root of the difficulty.

The reasoning which has led to the establishment of the gauge limit has been somewhat as follows: lobsters come to breeding age when 9, 10 or 10½ inches long, and when they spawn they spawn many thousands at a time, which is true. Therefore, by placing the legal gauge at 9 or 10½ inches we allow this animal to breed at least once before it is sacrificed, which is also true in the main. Ten-inch lobsters lay on an average 10,000 eggs; the lobster, being a good mother to her unhatched progeny, and the best incubator known, will bring most of these eggs to term, and will emit to the sea her young by the tens of thousands. What more is needed to maintain this fishery? The answer is, Vastly more. This race needs eggs not by the tens of thousands merely, but by the tens of billions, and it must have them or perish. Moreover, it can get them only or mainly through the big producers, the destruction of which the present gauge laws have legalized. If the lobster is a good "incubator," the sea is a very poor nursery. We have put a false value upon the egg.

Before proceeding farther in this analysis, we must glance at the most pertinent facts in the biology of the lobster. These facts concern chiefly: (*a*) the period of maturity of adult lobsters; (*b*) the number of eggs borne by the females, or the size of the broods; (*c*) the frequency of spawning; (*d*) the treatment which these eggs receive, or the habits of spawning lobsters; (*e*) the habits of the fry or larvæ; and (*f*) possibly more important than all else, the death rate or the law of survival in the young.

The phrases "egg lobster," "berried lobster," or "lobster in berry," or "lobster with external eggs," are all synonymous, and always mean a female with her cargo of eggs, new or old, attached to the swimming feet under the tail.

(*a*) Lobsters do not mature at a uniform age or size, but females produce their first broods when from 7 to 11 inches long, approximately, the difference between these limits representing a period of from two to three years (age of female lobsters at these limits about three and eight years, according to Hadley). Very rarely are eggs laid before the 8-inch stage is reached, and the majority are mature at 10 or 10½ inches, when some have reared more than one brood. Accordingly, by merely reducing the 10½-inch gauge to 9 or 8 inches we rob the animal of the very meager protection which it now enjoys.

(*b*) The number of eggs produced increases with surprising rapidity in proportion to the cube of the length or the total volume of the body, from the very beginning of sexual maturity. The approximate

number of eggs at 8 inches is 5,000; at 10 inches, 10,000; at 12 inches, 20,000; at 14 inches, 40,000; at 16 inches, nearly 60,000; and at 18 inches, nearly 80,000. In the case of 532 10½-inch berried lobsters taken from the waters of this State, the smallest, average and largest number of eggs borne were 5,000, 13,000 and 36,000. The smallest number probably represents a first brood, so that the average berried lobster at this size is probably carrying eggs for the second time. The maximum of production is reached at the 15 to 16 inch stage when some individuals produce nearly 100,000 eggs at one time.

The average 10½-inch berried lobster is from five to seven years old; and assuming that it has borne eggs once before, it has lived to produce 23,000 eggs. On the other hand, an egg-bearer 16 inches in length which according to Hadley's estimate is nearly eighteen years old, has had a succession of eight broods and has produced 210,000 eggs. The larger animal is thus worth nine times as much as the smaller; in other words, in the course of twelve years its value to the fishery has been increased 800 per cent.

Again, it should be noted that it is the class of small adults up to, but not including the 9 or 10½-inch animals, those which produce by the fives or tens of thousands, upon which we have relied to maintain the race, while it is the class of big animals which produce the fifty and the hundred thousands which has been nearly wiped out.

It may be added here that the male lobster matures as early as the female, and possibly earlier; and that the female may be impregnated at any time, and by more than one male. The sperm is received into a peculiar pouch or seminal receptacle on the under side of the body of the female, between the third pair of walking legs. The sperm has great vitality, and will endure in this condition for months and possibly for years.

(*c*) There is a definite spawning period for the majority of adults, ranging on this coast from July 15 to August 15, and averaging two weeks later in northern Maine. A relatively small per cent. lay their eggs in fall and winter.

(*d*) It is a fact, though frequently denied, that the lobster lays her eggs, as already stated, but once in two years (though rare exceptions to this rule may be looked for), and not annually, as was formerly supposed. This was first proved by the anatomy and growth of the reproductive organs,[1] and was confirmed by the statistics of the fisheries and by experiments conducted on a large scale by Appelöf[2] at the fisheries station at Stavanger, Norway, in 1899.

(*e*) The eggs are not deposited on sand or trusted to the mercy

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[1] Herrick, Francis H.: "The American Lobster; a Study of its Habits and Development," Bulletin of the United States Fish Commission for 1895, pp. 70, 246 (description Fig. 138). Washington, 1895. Also, "The Reproductive Period in the Lobster," Bulletin of the United States Fish Commission for 1901, pp. 161–166. Washington, 1902.

[2] Appelöf, A.: "Mittheilungen aus der Lebensweise des Hummers." Mittheil. des Deutschen Seefischerei-Vereins. Bd. 15, s. 99. Berlin, 1899.

of the sea, but are carried attached to the under side of the tail, and admirably guarded by parental instinct for nearly a year, or until they are hatched ten or eleven months later.

It may be also added that lobsters move from deeper water towards the shores in spring, and return to deeper water in fall. The laying of the new eggs and hatching of the old, followed by a moult or casting off of the shell, takes place, as a rule, in warming, but not necessarily in very shallow, water. There is no general coastwise migration, nor do all execute the same movements to and from the shore.

Ignorance of the fact that there is a definite spawning period, that the eggs are laid but once in two years, and that they are subsequently carried for ten months, to hatch in June or July following the summer when laid, is responsible, in considerable measure, for erroneous ideas regarding the efficacy of closed seasons, laws protecting the berried lobster, and other matters of legislation, the effects of which have not yet worn away.

(*f*) The fry or young, when hatched, rise to the surface or towards it, and lead a free-swimming life for three weeks, hardly larger than a mosquito (being a little over one-third of an inch long), and infinitely more harmless, translucent, brilliant in reds and blues, and quite helpless in the presence of all but the minute animals upon which they prey. They perish by the thousands quickly before the storm and the countless fish and other enemies which they meet in their varied movements, and which do not disdain small fry.

At the third moult, or the fourth, counting that passed at the time of hatching, with what seems like a sudden leap and bound, they are transformed into the fourth or the lobsterling stage, which really looks like a little lobster. The six pairs of flexible oars at the sides of the body have been cast off, and permanent swimming feet have appeared under the tail. There is a new armor or shell, resplendent in reds, greens and browns, and a brand new equipment of instincts and other powers. For the first time it knows fear, and in either this or in the fifth stage which follows it goes to the bottom, hides under stones, burrows in the sand and shows an ability to protect itself. The most critical period of infancy being now past, one lobster at this stage is worth many thousands in the first. Therefore, our efforts, to be of real avail, should not end with the hatching and immediate liberation of the fry; we should rear them to the bottom-seeking stage.

(*g*) What is the death rate or the rate of survival in the lobster? Upon the answer to this question hinges the gauge or legal length law, as well as the expensive practice of hatching and turning loose the young, which has been pursued in this country and Canada for many years (since 1886 in the United States and since 1891 in Canada).

As was pointed out ten years ago,[1] too many fish culturists have been content to turn out so many thousands or millions of eggs of lobsters and fish, and confidently expect results, to the neglect of the most important question of the whole business, — the rate of survival in the young set free, or the number of adults which can be raised from them, the very end for which all the time, trouble and money have been expended.

In the popular mind, an egg is an egg, like that of the fowl which we eat for breakfast. An egg really represents opportunity or chance to survive, and its biological value to the race depends upon the law or rate of survival, which was definitely fixed in nature before the advent of man with his traps and hatching jars, and differs in every species of animal and plant known. When the gauntlet of life is long and hazardous, especially in infancy, nature, as in the present case, multiplies the chances or multiplies the eggs. Many eggs always means death, under natural conditions, to all but a remnant of the host. The number of eggs alone serves as a rough gauge to determine the rate of survival.

At one end of the scale stand the birds and mammals, with few eggs and the highest life rate known, secured by guarding and parental instincts, with big yolks and rapid development in one case and the special conditions of fetal life in the other. At the other extreme we find a parasite like the tapeworm, where the conditions of early life are so unpromising — since it must run a long hazard of chances, and be eaten by two distinct vertebrates — that its eggs are required by the hundreds of millions or even billions. The lobster needs more eggs than the trout, and of smaller size, but far less than the edible blue crab, which sometimes carries five millions of eggs attached to its body. Each one of these is smaller than the dot over the letter *i* of ordinary print, and it must pass a long and dangerous larval period before reaching maturity.

What, then, is the life rate or rate of survival in the lobster? Probably not more than 2 in 30,000, and *certainly* not more than 2 in 10,000. This number would be exactly known, provided we knew the proportion of the sexes or the proportion of the total number of males to the total number of females, and the average number of eggs laid by mature females during their entire life.

Since the sexes are about equal numerically, it is only necessary, to maintain the species at an equilibrium, for each pair of adults or for each adult female to leave two children which attain adult age, whatever the actual length of life in either generation. If the adult progeny exceeds two, the race will increase; if less than two, it will

[1] Herrick, Francis H.: "Protection of the Lobster Fishery," Bulletin of the United States Fish Commission for 1897, p. 221. Washington, 1898.

diminish. Since under present conditions the race of this animal is falling off, the actual rate of survival for the individual having remained the same, the total number of survivals only has changed. In other words, there is at present a deficiency of eggs.

What is the average number of eggs for the entire life of this animal? We know the minimal and maximal limits of egg production in individuals (roughly, 3,000 and 100,000); we know the average number of eggs borne at the average age of maturity (at the 10-inch size, 10,000 eggs); but, as Allen,[1] in discussing this question, points out, we do not know the number of female lobsters destroyed at different ages. Many after laying their first eggs are killed before any young are allowed to hatch, and the number which survive to produce successive broods is a constantly diminishing one; but this is made good in part by the rapid increase in the number of eggs.

The average number of eggs borne by all the berried lobsters captured should give us an indication of the average number of eggs borne by all female lobsters during life, — the number sought. In 4,645 egg lobsters from the Woods Hole region, Massachusetts, the average number of eggs was 32,000, which would correspond to a 13 or 13½-inch lobster which had produced three or more broods. Allen found the number of eggs borne by 96,098 lobsters caught in Newfoundland to be 2,247,908,000, which would give an average of 23,000 to each female. This number corresponds to an animal 12 or 12½ inches long, which, as he remarks, from the known average age at which female lobsters mature (10–10½ inches), would be carrying at least a second brood. Such a lobster must therefore have produced 13,000 eggs (the average product at 10½ inches) plus 23,000, or at least 36,000 in all. We are therefore right in concluding that the maximum rate of survival of 2 in 10,000, formerly given,[1] was much too high, as it was known to be at the time, and that the proportion of 2 to 30,000 is much nearer the truth. Another estimate, by Meek,[2] based upon the statistics of the fisheries of Northumberland, Eng., gives a life rate of 1 in 38,000.

If it is then true, as we are thoroughly convinced that it is, that the normal rate of survival in the lobster is not greater than 2 in 30,000 or 1 in 15,000 (and it cannot be greater than 2 in 10,000), the fact is big for the lobster fishery, and the sooner it is faced the better. It has a direct bearing upon our laws and fishery operations. It enables us to truly evaluate the egg and the egg lobster. It shows in a conclusive manner that the present gauge laws are indefensible, because they rob the fishery of the billions of eggs necessary to maintain it. It further shows that the method of hatching the eggs of this

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[1] Allen, E. J.: "The Reproduction of the Lobster," Journal Marine Biological Association, Vol. iv. (N. S.). Plymouth, 1895–97.

[2] Meek, A.: "The Crab and Lobster Fisheries of Northumberland." Report for 1904. Newcastle-upon-Tyne, 1904.

animal and immediately liberating its young is ineffective, because of the meager results which can come from it. On the other hand, it speaks loudly in favor of a law to protect the large egg producers, and of the newer plan of rearing the young to the bottom-seeking stage, as the only means by which pisciculture can hope to materially aid this fishery.

The importance of the law of survival to the operations of the fisheries, and especially in its bearing upon some of our present illogical laws, is the only excuse for dwelling upon it at this length. To illustrate further, — with respect to period of maturity and value to the fishery, all lobsters in the sea may be divided into three classes: (1) the young and adolescents, mainly from egg or larva, to the 8-inch stage; (2) intermediate class of adolescents and adults, 8 or 9 to 10½ inches in length; and (3) large adults, mainly above 10½ inches long. The biological value of the individual increases with every stage from egg to adult of largest size, and therefore is greatest in class 3. The present laws sanction the destruction of class 3, but class 1, the beginning of the series, must, as we have seen, be mainly recruited from this class, or from those animals which under present conditions are being wiped out. In other words, our policy shifts the duty of maintaining the race upon the small producers, which the law of survival plainly tells us it is unable to bear. There is no way of getting over this grave defect.

We speak of the "living chain" from egg to adult, but the metaphor is not a happy one. There is no "chain" relation in living nature, only a succession of individuals, of individual eggs, united in origin but discrete in each generation. The embryologist begins with the egg, but the fish culturist with the egg producer. Spare the egg producer, then, and nature will save the race. We cannot wholly take the place of nature in dealing with the eggs, but we can defeat the ends of nature by killing the "bird" which lays them.

But, do you say, "We have the egg lobster law, and the protection of lobsters in spawn should remedy our difficulties"? In reply, we have but to recall the fact that adults lay their eggs but once in two years, and consequently we should not expect to find more than one-half of this class with spawn attached to the body at any given time. This at once reduces the protection aimed at in the egg lobster law by one-half. The other half shrinks to small proportions when we consider that there is an overlap of four weeks in July between the climax of the periods of hatching and spawning, when the majority of all adult female lobsters are without eggs of any kind, and also when we further consider the ease with which a fisherman by a few strokes of the hand can make a berried lobster eggless.

When analyzed in the light of the law of survival, the showing of the lobster hatcheries is not very encouraging. The hatching and immediate liberation of the fry has been practised for many years in

Europe, where experiments were made in Norway as early as 1873, as well as in Canada and the United States. The whole number of fry hatched and liberated on the Atlantic coast for a period of ten years, according to official returns from the hatcheries of the United States, Canada and Newfoundland, reached a grand total of 4,214,778,-200. Applying the law of survival, with life rate of 2 in 30,000, which has been shown to be a fair allowance, this number of young would yield only 280,985, while there must have been captured on this coast in the same period nearly 1,000,000,000 lobsters. By applying the maximum rate of 2 in 10,000, which we are assured is far too large, the yield would be 842,955. To have held the fishery at an equilibrium by this means, there should have been hatched 5,000,000,000,000 young, or 1,250 times as many as were actually liberated.

To take another example, the total output of all the Canadian lobster hatcheries, for the entire history of this fishery, 1880 to 1906, was as follows: —

Bay View, N. S., 1891–1906,	1,889,300,000
Canso, N. S., 1905–1906,	79,000,000
Shemogue, N. B., 1903–1906,	291,000,000
Shippegan, N. B., 1904–1906,	220,000,000
Charlottetown and Dunk R., P. E. I., 1880–1906,	256,085,000
	2,735,385,000

Again, allowing the maximum rate of 1 in 5,000, this product of the activity of twenty-four years[1] would yield only 547,077 lobsters, or but little over the two-hundredth part of the numbers caught in certain years in Canada alone.

Such illustrations should make us pause to consider whether we have rightly evaluated the egg and the young in this animal. They show the hopelessness of restoring or of even maintaining this fishery by such a method when conducted on any possible scale.

In cases of this kind it is as detrimental to overestimate the value of the egg as to undervalue it. The eggs are true gold, although the amount which each weighs is infinitesimal. Like drops of water and grains of sand, these eggs count for but little singly, but in mass the inanimate particles can make the oceans and the continents, while the living germs can fill them with teeming inhabitants.

We cannot work on the colossal scale of nature in dealing with egg or larva, but we may frustrate nature by destroying the egg producers. Nature long ago provided for the cod, the shark and hundreds of other predaceous fishes; she took into account the tides, the storm and the rock-ribbed coast also, by giving to this race billions of eggs each year;

[1] No hatchery operations apparently having been conducted in the years 1888 to 1890, inclusive.

but no provision was made for millions of traps working night and day at the bottom of the sea to destroy the producers of these eggs.

The method of rearing the young through their critical larval or pelagic period, until they finally go to the bottom in the fourth or fifth stages, promises to materially aid this fishery. Some efforts were made in this direction by MM. Gullion and Coste[1] at Concarneau, France, as early as 1865, when the necessity of rearing the little lobster through its dangerous period of infancy was as clearly understood as now; but, though heralded with enthusiastic reports, little real advance seems to have been made.

In the years 1873 to 1875 experiments in the hatching and rearing of lobsters were again undertaken by several gentlemen at Stavanger, Norway,[2] both independently and with the aid of the Royal Society for furthering the Industries of Norway. According to the reports of Professors Rasch and G. O. Sars, they were eminently successful; many young lobsters were carried to the ambulatory or bottom-seeking stage, the necessity of which was duly emphasized, and incidentally important facts on the natural history of the lobster were brought to light. Again, whatever progress was made at the time, the work was not systematically continued.

In 1883 Saville Kent[3] contributed a paper on "The Artificial Culture of Lobsters," which later appeared in the proceedings of the International Fisheries Exhibition at London for that year. He contended that the chief cause of the decline in the lobster fisheries was the destruction of the lobster eggs, and that it should be combated by artificial propagation. As a result of experiments, he strongly advised paying a bounty for the egg lobster, hatching the eggs and rearing the young to the ambulatory stage before liberation.

Still later, in 1885, Captain Dannevig[4] also succeeded in hatching the eggs of the lobster and in rearing the young through the first three earliest stages, at Flodevig, Norway. He did not consider it of much service to hatch the eggs and to immediately set free the young; and he rightly said that, so great was the destruction in nature from storms and other causes, out of the 25,000 or 30,000 eggs which a lobster might produce, not a single one might reach its full development.

This work gave the first impetus to lobster culture in this country, where the hatching of eggs was accomplished in the summer of the

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[1] Mocquin-Tandon, O., and Soubeiran, J. L.: "Établissements du Pisciculture de Concarneau et de Port-de-Bonc." Bull. de la Soc. d'Acclimatation, 2d. Sér. T. II. Paris, 1865.

[2] Rathbun, Richard (reported by): "The Fisheries and Fishery Industries of the United States," sect. v., Vol. II., pt. xxi., pp. 736-738. Washington, 1887.

[3] Kent, W. Saville: "On the Artificial Culture of Lobsters," International Fisheries Exhibition, London, 1883, pp. 1-24. London, 1883.

[4] Raveret-Wattel: "L'Aquiculture Marine en Norvége," Revue Sc. Nat. Appliquées, T. 37. Paris, 1890.

same year (1885) at the newly opened laboratory of the United States Fish Commission, at Woods Hole, Mass., as reported by Mr. Rathbun.[1]

In 1894 we urged the importance of finding a means of rearing the young through the free-swimming stages, and thereby reducing the terrible death rate which inevitably occurs under natural conditions. As we then remarked: "If we could save 100 instead of 2 out of every 10,000 hatched, every million young would produce 10,000 adults, and every billion would yield 10,000,000 lobsters, capable of reproduction."[2]

While results somewhat similar to those outlined above have been obtained in England and in other parts of Europe, signal success in providing the young with a proper food supply and in maintaining them in a healthy condition up to the lobsterling stage has only been obtained in recent years in this country through the admirable work of Messrs. Bumpus[3] and Mead[4] and their associates. These experiments were begun under the auspices of the United States Fish Commission, at Woods Hole, Mass., in 1890, and were continued at other points on the coast, and especially at Wickford, R. I., where, under the direction of Professor Mead and of the Commissioners of Inland Fisheries of Rhode Island, the most efficient apparatus yet devised for the culture of lobsters has been gradually perfected and installed.

Given a water supply which has been found by experiment to offer favorable conditions for the growth of lobster larvæ, and a suitable food supply, such as minced clams, the apparatus mechanically aerates the water, and at the same time holds both the lobsters and their food in suspension in the water with little detriment to the larvæ themselves. Some experiments have been lately conducted by the United States Bureau of Fisheries at Boothbay Harbor, Me.

At an early stage in his work Professor Mead found that in no case was the number of lobsters reared to the fourth stage less than 16 per cent. of the total number of fry placed in the brood chambers (scrim bags, or wooden boxes, as now in use). The ratio of survival may even exceed 50 per cent. In 1901, between 9,000 and 10,000 lobsterlings were thus reared at the Wickford station to the bottom-seeking stage; in 1908, between 300,000 and 400,000 fourth or fifth stage lobsters were reared and distributed on the coast.

The rate of survival of the larvæ up to the ambulatory stage is not

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[1] Rathbun, Richard: "Notes on Lobster Culture," Bulletin of the United States Fish Commission, Vol. VI., p. 18. Washington, 1886.

[2] Herrick, Francis H.: "The Habits and Development of the Lobster, and their Bearing upon its Artificial Propagation." Bulletin of the United States Fish Commission for 1893. p. 86. Washington, 1894.

[3] Bumpus, H. C.: "The Results attending the Experiments in Lobster Culture made by the United States Commission of Fish and Fisheries." Science, N. S., vol. 14, pp. 1013–1015. New York, 1901.

[4] Mead, A. D.: "Experiments in Lobster Culture." Thirty-fourth Annual Report of the Commissioners of Inland Fisheries of Rhode Island for 1904. Providence, 1904. (See also later papers published in reports of the same commission for 1901 to 1903.)

known, but it is certainly not greater than 1 in several thousand, or a small fraction of 1 per cent.

Instead of striving to work on the vast scale of nature in dealing with the egg, this is an attempt to improve upon nature by lowering the death-rate in the most critical period. Great care, however, is needed at every stage of the process, and especially at the last, since the young do not seek the bottom at a uniform time.

Had it been our attempt to destroy this animal, could we have acted more effectively than by destroying its great egg-producing class? When we attempt to rid this country of the English or house sparrow, will it help greatly to break its eggs and destroy its young ones, though so relatively few and with a far higher life rate than in the crustacean? Must we not eventually kill the producers of the eggs, if we would be rid of the pest? This is the nature of the treatment which the lobster has received. If we would preserve this fishery, we must reverse our laws, as Dr. Field has ably pointed out, and follow the principles and practice of breeders of domestic animals everywhere: use the smaller and better animals for food, and keep the older, and in this case by far the most valuable, for propagation.

To apply the principles already discussed, I would make the following recommendations: —

1. Adopt a double gauge or length limit, placing in a perpetual close season or protected class all below and all above these limits. Place the legal bar so as to embrace the average period of sexual maturity, and thus to include what we have called the intermediate class of adolescents, or smaller adults. These limits should be approximately 9 inches and 11 inches, inclusive, thus legalizing the destruction of lobsters from 9 to 11 inches long only, when measured alive. In this way we protect the young as well as the larger adults, upon which we depend for a continuous supply of eggs. The precise terms of these limits are not so vital, provided we preserve the principle of protecting the larger adults.

2. Protect the "berried" lobster on principle, and pay a bounty for it, as is now done, whether the law is evaded or not, and use its eggs for constructive work, or for experimental purposes with such work in view.

3. Abolish the present close season; let the fishing extend throughout the year.

4. Wherever possible, adopt the plan of rearing the young to the bottom-seeking stage before liberation, or co-operate with the United States Bureau of Fisheries or with sister States to this end.

5. License every lobster fisherman,[1] and adopt a standard trap or

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[1] This recommendation has been re-cast and made more explicit in regard to the adoption of a standard trap with entrance rings of specified diameter, in accordance with a suggestion made by Governor Guild; and the subject of licensing the fishermen, which is herein included, was suggested by a recommendation made at the conference by Mayor Herrick of Portsmouth, N. H.

pot which shall work automatically, so far as possible, in favor of the double gauge, the entrance rings being of such a diameter as to exclude all lobsters above the gauge, and the slats of the trap of such a distance apart as to permit the under-sized animals to escape. Such dimensions should be determined by careful experiments, based upon those already made by Dr. Field.

Many objections can be raised, but this plan is defensible on scientific grounds, while the older methods are not. The best thing which can be said of it is, that it would eventually give us more eggs, and in an ever-increasing quantity, — the greatest need of this fishery, both now and in the future. Under present conditions, the supply of eggs is yearly diminishing, and at a tremendous rate.

The most striking objection to the proposed changes would be that if class 3, that of the big producers, has been nearly exterminated, and we proceed to wipe out class 2, the smaller adults, there will soon be no more lobsters; but this is not valid. No doubt if this change were made, the supply of smaller lobsters would be temporarily increased where the 10½-inch gauge law still prevails, as was the case in this State in 1907 when the 9-inch law went into effect; and this might be followed by a temporary stringency. No one can speak with positive assurance upon this subject, but the important point to bear in mind is, that under such an arrangement we would have a perpetually protected class constantly growing, and at work all the time.

Again, it may be asked, Will enough lobsters survive to enter the exempt class? We believe that there would, and that the answer to this question is to be found in the records of catches for every locality where lobsters are now trapped. Even in places where the average size is small, larger lobsters occasionally appear, and in sizes showing more than one year's growth. Why were not all such animals weeded out the previous year? Instead of waiting to be caught up in the end, these "escapes" would all enter the protected growing class, to enjoy a green old age of fifty years and possibly more; but we have no positive knowledge of the life span in this interesting race.

The trouble of a double gauge, such expense as would be needed in adjusting traps to admit and hold lobsters of the legal size, would have to be met, and it would be well worth while. In our opinion, the markets would not be seriously disturbed. Protect the big egg producers, and nature will preserve the race.

Collection and Purchase of Lobsters with Eggs attached. — Acting under the provisions of chapter 408, Acts of 1904, the launch "Egret" purchased from the fishermen 2912 lobsters, weighing 6,279¼ pounds, at an average price of 20 cents per pound; and, in addition, 261 lobsters above 12 inches long at 40 cents each and 91 below 12 inches long at 25 cents each.

Of these lobsters, 197 were sent to the hatchery of the United

States Bureau of Fisheries, at Woods Hole; 378 were sent to the United States Bureau of Fisheries station, at Gloucester; 2,337 were liberated off shore; of these, 49 were recaptured by fishermen; 47 were therefore purchased twice, and 2 three times, as indicated by punch marks in edge of the shell on the tail.

Deputy Mecarta purchased from fishermen at Chatham and East Orleans 1,254 lobsters, weighing 4,314½ pounds, at an average price of 14 cents per pound. All of these lobsters were liberated off shore.

The total number of egg-bearing lobsters purchased from the fishermen in 1908 was 4,518, and of these nearly 87 per cent were liberated and the eggs therefore hatched in the sea under natural conditions.

Table showing Measurements of Egg-bearing Lobsters collected by the Commissioners on Fisheries and Game during the Years 1906, 1907 and 1908.

Size (in inches).	Number.	Size (in inches).	Number.	Size (in inches).	Number.	Size (in inches).	Number.
7¾	1	10½	653	13¼	317	16	67
8	1	10¾	389	13½	499	16¼	6
8¼	1	11	987	13¾	205	16½	17
8½	1	11¼	370	14	483	16¾	3
8¾	3	11½	746	14¼	76	17	14
9	16	11¾	433	14½	169	17½	5
9¼	12	12	212	14¾	48	17¾	1
9½	69	12¼	1,135	15	158	18	4
9¾	53	12½	1,048	15¼	11	18¼	2
10	217	12¾	628	15½	54	19¼	1
10¼	86	13	1,114	15¾	10		
Total,							10,325

DEPARTMENT OF COMMERCE AND LABOR, BUREAU OF FISHERIES, GLOUCESTER, MASS., June 5, 1909.

Commissioners on Fisheries and Game, Room 158, State House, Boston, Mass.

GENTLEMEN: — I submit herewith a brief report of the lobster work accomplished at Gloucester, Mass., station during the season of 1908.

During the season of 1908, 1,283 egg-bearing lobsters were received at this station, of which 419 were collected in the fall of 1907 and

held in live-cars till the following spring, and 864 were collected during the spring months.

The total yield of eggs for the season amounted to 14,495,000, from which were obtained 12,760,000 fry, which were distributed in Massachusetts waters.

The experiment of holding egg lobsters in live-cars through the winter months did not prove a success, as only 122, or 29.1 per cent., were taken out alive in the spring. This severe loss was probably due to overcrowding the lobsters while waiting for a larger car to be constructed.

Of the total egg lobsters received, 507 were furnished by the Massachusetts commission.

Respectfully, C. G. Corliss, *Superintendent.*

Statement of Fish and Eggs distributed from Gloucester, Mass., Station for Season of 1908.

[Species, lobster; age, fry.]

Date.	To whom delivered.	Address or Point of Deposit.	Water stocked.	Number.
1908.				
June 11,	Bureau of Fisheries, consignment.	Manchester, Mass.,	Massachusetts Bay,	600,000
13,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	420,000
16,	Bureau of Fisheries, consignment.	Salem, Mass.,	Massachusetts Bay,	1,000,000
18,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Ipswich Bay,	480,000
20,	Bureau of Fisheries, consignment.	Rockport, Mass.,	Loblolly Cove,	360,000
20,	Bureau of Fisheries, consignment.	Rockport, Mass.,	Ipswich Bay,	900,000
22,	Bureau of Fisheries, consignment.	Beverly, Mass.,	Massachusetts Bay,	450,000
22,	Bureau of Fisheries, consignment.	Manchester, Mass.,	Massachusetts Bay,	450,000
24,	Launch "Egret,"	Nahant, Mass.,	Massachusetts Bay,	500,000
24,	Launch "Egret,"	Boston, Mass.,	Massachusetts Bay,	1,000,000
27,	Launch "Egret,"	Boston, Mass.,	Massachusetts Bay,	1,300,000
30,	Launch "Egret,"	Cohasset, Mass.,	Massachusetts Bay,	700,000
30,	Launch "Egret,"	Scituate, Mass.,	Massachusetts Bay,	800,000
July 3,	Launch "Egret,"	Nahant, Mass.,	Massachusetts Bay,	800,000
6,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	500,000
8,	Launch "Egret,"	Swampscott, Mass.,	Massachusetts Bay,	560,000
11,	Bureau of Fisheries, consignment.	Rockport, Mass.,	Ipswich Bay,	240,000
15,	Bureau of Fisheries, consignment.	Rockport, Mass.,	Ipswich Bay,	450,000
18,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Ipswich Bay,	480,000
20,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	240,000
23,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	320,000
25,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	160,000
28,	Bureau of Fisheries, consignment.	Gloucester, Mass.,	Massachusetts Bay,	50,000
	Total,			12,760,000

DEPARTMENT OF COMMERCE AND LABOR, BUREAU OF FISHERIES.
WOODS HOLE, MASS., June 12, 1909.

Commissioners on Fisheries and Game, Room 158, State House, Boston. Mass.

GENTLEMEN: — In accordance with your request of May 28, 1909, I beg to submit the following brief report of the lobster work done at this station during the season 1908.

The collection of egg-bearing lobsters was begun in October, 1907, and continued into December of the same year; 474 were received during that time; 310, or 65.4 per cent., of these survived the winter and yielded 3,666,000 eggs. Collections were begun again about the middle of May, 1908, and continued during June. Our receipts for the territory adjacent to the station were slightly in excess of those of the previous year, but the yield from the territory north of Cape Cod, which is covered by one of your launches, showed a very marked falling off, the receipts being only about 11.6 per cent. of those of the previous year. A total of 23,337,000 eggs were received, and from these, 18,419,000 fry were hatched and liberated in Massachusetts waters. These eggs were taken from 2,792 lobsters, 353 of which were furnished by the employees of the Massachusetts commission, the remainder being collected by the force at this station.

Respectfully, E. F. LOCKE, *Superintendent.*

INLAND FISHERIES.

Trout. — We believe that the time will come when the people will demand that certain brooks be acquired by the State, to be set apart and stocked, for the purpose of furnishing healthful and sane recreation for the public. Such a proceeding would be as logical as public parks, gardens, base ball and golf and tennis grounds.

On account of the drought this year enormous quantities of trout were destroyed, not alone in the nursery brooks, but where the large fish were compelled to resort in numbers. As an instance, we quote from the daily report of Deputy Ruberg: —

We drove to Rowe, and found that the people were up in arms because people were catching so many trout out of Pelham Pond. Yesterday, July 8, there were 141 pounds of brook trout brought into Charlemont from that pond, and all were taken with a hook and line. The pond is low, and there is very little water running in; but where the main stream runs into the pond the water is shallow, and the trout run up there, evidently to get at the cool water. The trout lay in this spot just as thick as they can lay, and the men bait their hooks just

enough to cover the law, and hook them out, as they do not seem at all wild. The fish run in weight all the way from ¼ of a pound to 2 pounds, and it is a fair estimate that 500 pounds of trout were taken this week up to last night. This pond is an artificial pond, but was never stocked, only as it has stocked itself. We informed the owners that they had only to post for trespass, and it would probably stop this slaughter, as we could not see where there was any violation of the fish laws.

The artificial propagation and distribution of trout has been carried on as usual. The total output from the Sutton hatchery showed a marked increase over any previous year, chiefly as the result of increased experience in dealing with local conditions, and in part due to the construction of new pools and the progressive extension of protection to the young fish.

So much of Superintendent Merrill's report as relates to the propagation of trout follows: —

To the Commissioners on Fisheries and Game.

Gentlemen: — I herewith submit a report on the hatching and raising of trout and the work connected with the same.

The eggs collected in 1907 for hatching in the present season amounted to 50,000 from the brown trout and 627,000 from the brook trout, — a substantial increase over the usual number collected for several years, due in part to the new stock of breeders secured in the previous December. These fish, as yearling spawners, gave 216,000 eggs, or an average of nearly 400 for each female spawned.

The brown trout eggs hatched with the usual small percentage of loss, which is less than half the usual loss of brook trout eggs; and the fry were successfully raised in the pools below the dam, passing the summer in that trying water with no appearance of disease among them.

Rainbow trout eggs numbering 15,000 were received from the United States Bureau of Fisheries, and were successfully hatched and reared, growing to large fingerlings in the lakes that were out of use the previous season.

Two hundred thousand of the brook trout eggs were sent to Winchester, and the 427,000 remaining were hatched here, resulting in 375,000 fry.

The quality of the fry has probably not been equalled since the hatchery was established, and as a result the fingerlings raised were of excellent quality and more than double the usual number.

Two of the three things that mainly contributed to this end — the use of outside hatching troughs, and the protection of the hatchery water

supply by collecting it in covered tile drains in place of open ditches — are permanent, and can be expected to aid in more successful hatching each year; but the third and perhaps the most important — the large volume of water flowing from the springs, resulting from the heavy fall rains — is exceptional, and may not occur again in several years.

The flow of water was so abundant as to fill the pipe to the hatchery to its full capacity, and by its more rapid flow to pass through with less reduction of temperature. During the winter it was not noted below 40°, but during the previous winter it frequently fell to 34°. The pipe through its 500 feet of length is not in many places below frost, and a part of its length is laid on the bottom of the pond, where the cooling influence of the surrounding cold water is even greater; consequently, the temperature of the water in its flow in the pipe is always reduced, and in the case of a scanty flow to a point as low as the surrounding influences.

The drought of the present season promises low water for the winter of 1908–09, with the probably accompanying low temperature that will delay the hatching at least three weeks or more. That this is a serious injury to the fish, resulting in a poor lot of fry for the spring distribution and likewise an inferior lot of fingerlings, is established beyond a doubt. The remedy is equally certain, and consists of increasing the number of outside rearing troughs placed at the springs, or, what would be still better, the use of these troughs in a temporary building until a similar permanent arrangement can be made.

The large increase of trout fingerlings was due mainly to the excellent quality of fry, that made it possible to stock the ponds to their full capacity and to carry the fish through the summer without loss. The improvements which have been made in giving the ponds shade and protection have also aided largely.

The sixteen troughs made for hatching were used for rearing, and these yielded 15,000 fish. Pond No. 3, formerly used for rainbow trout, gave 8,000; 9,000 were grown in a new pond built above Pond No. 6. These additional ponds were stocked with fish which had been carried in the outside troughs until the ponds could be made ready, which was much later in the season than they could be carried in the hatchery troughs.

The work on the grounds and houses was curtailed, and only the extension of facilities for raising fry received much attention, this work being mainly the planking of these lower ponds where rock and quicksand made concrete work impracticable. In addition to this was the construction of a new pond with a concrete dam in the old channel of the brook above Pond No. 6; the enlargement of the pool below the main dam, putting in concrete and gravel banks, to receive adult brown trout, so that the pens below could be used for fry; and the partial construction of two concrete pools to such a stage that they could be readily finished for receiving fry in 1909.

The development of the hatchery should continue, as in the past, by making extensions where it can be demonstrated that any extension will not detract from the efficiency of the existing ponds, and by replacing the decaying wooden pens with permanent work of concrete.

There is a probability that the output of fingerlings could be increased by utilizing outlying springs, which are so near that the fish can receive daily attention from the hatchery. The water available for this work would rear 30,000 to 40,000 fingerlings, and the expense involved in making ponds at these springs would be far less than would be required for an equal number of fingerlings on the hatchery grounds.

The hatchery equipment is in a very advanced stage of decay, and measures to remedy it cannot be long delayed, but it would be unwise to merely repair. The hatching troughs are those of forty years ago, and are generally discarded; while the house, from its faulty location, has been a serious handicap in carrying on the work of the station. As originally attempted, the hatching was a virtual failure for a succession of years, and was made tolerable by many costly changes, which have involved seeking the water supply from six different sources and laying three lines of supply pipe, each approximately 500 feet in length. Some of the sills of the building are entirely gone, the floor in part has fallen and rests on the mud beneath, and by steadily settling is constantly throwing the troughs out of level, so that in spite of careful watching the loss of eggs from interrupted circulation of water cannot be wholly prevented. The decay into which the building has fallen makes it a perfect harbor for rats; they enter it at will, and seriously damage the eggs. In the spring they go out to infest the bird pens, requiring continuous warfare through all the year to keep them in check.

The main difficulty which results from the unfortunate location of the hatchery and water supply is retardation of hatching, which causes loss from weakness and disease, and inferior fry for distribution and for stocking the rearing ponds. In addition, the present location and equipment is entirely useless in the season for raising and distributing fingerlings and in handling spawning fish for taking eggs. The more modern equipment in general use at the State and federal hatcheries would be useful equally in hatching eggs and in rearing fingerlings, and also would facilitate counting them into lots for shipping when they are taken from the ponds for that purpose. The fingerlings thus reared could be produced with considerable economy of water, thus largely increasing the output; and the fingerlings, when ready for shipment, would go out in exact lots to each applicant, — something that cannot be done at present, through lack of equipment.

The records kept here show a wide variation in the spawning of the trout. These variations are correlated with changes in the stock. In the years from 1899 to 1901 the stock consisted very largely of a strain

of sea trout from the streams flowing into Buzzards Bay; the average number of eggs per fish increased from 1,000 in 1898 to 1,500 the next year and 1,800 in 1901, but the spawning was very late, the fish yielding heavily in December or late in November. By 1902 this stock was considerably depleted, and was largely replaced with stock grown from the wild trout of Lake Quinsigamond. The fish caught for spawning were unusually fine specimens, ranging in weight from 1 to 5 pounds. The eggs were taken in 1899, and the fish were spawned as two-year-olds in 1902. The spawning was early that year, the fish yielding early in November, but the average number of eggs per fish was reduced to 1,000. The following year the stock was mainly three-year-olds, no two-year-olds having been added, and the average was 1,400, but by 1906 and 1907 it fell to 900. For the present year an increase to 1,000 is shown, the breeders being mainly private hatchery stock, and a further increase may be expected when they spawn as three-year-olds. The yearlings have at all times been spawned and accounted for separately, the fish two years old or more together; and the proportion of two, three and four year olds that have spawned have influenced the yearly averages somewhat, but not so much as to impair the value of the record in indicating the stock of fish best for breeding here.

For the purpose of comparing fry from yearling and from adult fish, and to determine the relative value of eggs from yearling trout for rearing brood stock, fry from adult breeders descended from the Lake Quinsigamond stock and fry from the yearling private hatchery stock were grown in parallel lots, as follows: Lot 1A, old stock fry in rearing tubs; Lot 2A, old stock fry in rearing troughs; Lot 3A, old stock fry in ponds; Lot 1B, yearling fry in rearing tubs; Lot 2B, yearling fry in rearing troughs; Lot 3B, yearling fry in ponds.

The conditions were nearly identical. The fry from adult stock hatched earlier, and, being from larger eggs, had an advantage in size in the beginning; but by midsummer the yearling fry equalled them in size, and by the end of the season showed much superiority in size, condition and numbers. This seems to indicate that the strain of fish developed at the commercial hatcheries are especially adapted to the conditions introduced by domestication, at least so far as relates to rapidity of growth and to earlier maturity. In the two years that these fish have been spawned as yearlings, practically none of the females have failed to develop eggs; while in the old stock a very large proportion did not develop eggs until two years old. This early maturity is of the greatest importance in natural reproduction in streams. Few fish that failed to spawn as yearlings would live to spawn as two-year-olds; and the smaller fish have a great advantage in effective spawning, as they are able to reach and to spawn in the upper parts of the stream, where the eggs are less liable to be destroyed and the fry have a better chance to live.

The matter of purchasing lands and of improving the road leading to the hatchery grounds is again urged, for the reason that the unpleasant and unsafe conditions incidental to leaving or entering through land that is used as a pasture still continue. Since this was explained and some improvement urged, several years ago, the number of visitors has largely increased, particularly of individuals, parties and schools, seeking information concerning this branch of the State's work. To many of these it is very annoying to have to enter the grounds by making detours over wet or bushy land and climbing intervening fences. Additional land is also needed for bird work. During the present season it was found advisable to go outside the grounds, and this will be a necessity in the future. The margin of the strip suggested for the road would fill a part of this need admirably. Further, to control the water supply and protect the timber shading the upper springs, additional lands should be bought. This land, however, would not be of much use in bird work.

The recommendations for increased land and for suggested improvements if carried out would not be entirely sufficient to place the station on a fair basis for carrying on the work to its natural capacity. It would still require many minor improvements to properly economize the time required for routine work. Power is urgently needed for chopping meat. A water wheel or gasoline engine would supply this at a cost less than the annual cost of labor applied to chopping meat by hand. A cooking house is indispensable, but the one in use is the same temporary shed erected six years ago for one summer's use. The ice box was bought nine years ago, at a cost of $2, and will neither hold nor keep fresh the ordinary supply of meat. The meat house is too small to shelter either the ice box or the cooking facilities. This has made it inexpedient to carry out the small improvements, as these changes would in the aggregate be unnecessarily expensive, and to delay the changes which are reasonable and necessary for a permanent arrangement. The meat house should be replaced with a building of sufficient capacity to shelter power, refrigerator and cooking facilities, including dryers for bird food, as well as the means for preparing fish food. We are certain that the entire cost of these suggested changes would be wiped out within two years by increased economies in administration.

Respectfully submitted, ARTHUR MERRILL.

Migratory Fish. — After a controversy extending over many years, the passage of alewives up the Nemasket River into Assawompsett Lake is assured by the co-operation of the town officials and the owner of the dam, through the construction of a stone and cement fishway, which closely simulates nature by providing a series of pools under the bridge at Wareham Street, Middleborough.

We desire again to call special attention to the fact that more rational methods of dealing with the shad are immediately necessary, if the supply is to be maintained.

Pollution. — The water courses of the New England States have long been regarded as natural sewers by unwise individuals and corporations. Doubtless there are many special instances where sewage, manufactory wastes and other materials can be commercially disposed of only by such methods. Such instances must have individual consideration, and it would be decidedly unwise to handicap any manufacturing enterprise, however small or large, by compelling the adoption of an expensive method of disposal. On the other hand, in many instances material is permitted to enter, either directly or indirectly, which could be better disposed of on land, resulting not only in most cases in a very considerable and in the aggregate a stupendous loss of nitrogenous substances which are needed for agricultural operations, but also rendering the streams unsuitable for fish life and at length a menace to the public health.

In this connection the following resolution was adopted at the conference of commissioners held in connection with the Conference of Governors for the Conservation of the Resources of the New England States: —

Whereas, In all New England States there exist conditions whereby the public waters are becoming annually more polluted by the introduction of sewage, manufactory wastes, etc., resulting in a distinct menace to the public health and seriously impairing the productive capacity of the water and of the land under the water; and

Whereas, With increasing population these waters and submarine areas are becoming more necessary for the production of human food, both of fish and shellfish, both for local consumption and for sale in distant markets; and

Whereas, A private individual or corporation is not permitted by law to run sewage, manufactory waste, etc., upon the land of his neighbor, similarly it should not be permitted to run these materials into public waters or upon public land; therefore, be it

Resolved, That it is the carefully considered opinion of this conference of delegates, meeting in Boston in this the first annual conference called by the Governors of the New England States, that the

unnecessary pollution of the public streams and coastal waters should be immediately and decisively checked by suitable action of the respective legislatures.

Game and Insectivorous Birds.

We are of the opinion that constantly increasing attention to the maintenance by artificial propagation and protection of the native varieties of birds is more essential at present than the introduction of new varieties, such as the Hungarian partridge, the migratory quail, the capercailzie and "black game." Massachusetts is favored above practically all the States east of the Mississippi, from the fact that it has possibilities of maintaining in relative abundance the three most notable species of game birds, — the quail, ruffed grouse and pinnated grouse. The ruffed and pinnated grouse find here no difficulties connected with climatic conditions, and the problem is solely their relation to man and conditions introduced by human agencies. With quail, however, the question is further complicated by the fact that, while the quail are fitted by nature to withstand any degree of cold, they are especially subject to the ill effects of the sleet storms of New England.

Of the unfavorable conditions introduced by man, the destruction of covers and breeding places will doubtless be remedied by the results of reforestation, and by that increase of orchards and of grain fields which must follow the increase of population in Massachusetts and the incidental increased demands for fruit and grain. The most serious problems (which, however, are fortunately within the control of man) are the destructive effects of the increased number of cats, rats, mice, squirrels and English sparrows, together with certain infectious diseases, both of plant and animal nature; for example, various types of bacilli which cause infectious intestinal diseases in birds, and several species of animal parasites, notably coccidia of various species. Of all these diseases as yet practically nothing is known as to the life histories of the organisms, what species are liable to infection, the manner of infection and the remedies. It is known, however, that these diseases are spread by domestic fowl, by the English sparrow and certain other species of wild and domesticated birds. They are transported mechanically

in dust from hen yards, etc., by the wind, and to a certain extent doubtless by rainfall and water courses. Special knowledge is imperatively demanded if we would check an unnecessary destruction of bird life.

In spite of all these untoward conditions, which can and must be promptly and properly dealt with by man, the covers of Massachusetts are amply able to support a large population of birds, — certainly 50, and possibly 100 or 200 or more grouse to the square mile, and even larger numbers of quail. The development of good roads and the extension of the possibility of travel by automobile and trolley cars make these covers far more accessible than those of any other State in the Union, with the result that a relatively larger number of hunters go afield from the exceptionally large number of cities within our borders, carrying with them the best type of equipment, both in guns and ammunition and in carefully trained dogs. It is, however, possible for the Commonwealth to meet these conditions and provide a suitable remedy. It is a notable fact that the older countries, for example, Germany and England, have passed through a similar condition, and have now a far greater number of birds per square mile than has probably any State in the Union. In other words, the annual bird crop in England, Germany and France is able in a much greater measure than with us to control the insects injurious to vegetation, and to provide a surplus of game birds for food to such an extent even that at least two species of wild plover, in addition to semi-domesticated pheasants and grouse, are exported from these countries to Boston and New York markets, and sold at a price less than that at which our native game is offered. Well-advised and extensive operations for developing our bird population, for the purpose of providing an adequate safeguard against the advances of insect pests, for example, the gypsy moth, cut worms and other noxious insects, are necessary, as well as to maintain an æsthetic asset of the State, and to provide game birds for food and recreation. Action should be taken particularly by enacting such laws as will not alone permit but encourage the rearing of birds of all species under suitable conditions by people who are properly qualified to undertake the work, either for pleasure or profit.

Under our laws as interpreted by the highest courts of the land, the fish, birds and game are the property of the State, but the regulation of their capture is within the police power of the State; further, the fish and birds do not become the property of the person upon whose land they chance to come for the time being. The history of both fish and game legislation has been almost exclusively one of progressively increasing restriction. In spite of all these restrictive laws, wise and otherwise, there has been a constant diminution in the number of species and the number of individuals. Several species have been entirely exterminated, and many species, formerly notable for the extreme number of individuals, have been reduced almost to the verge of extinction. The statement that a public supply is always subject to irrational use is but to repeat a commonplace which has become obvious in the case of marine and fresh-water fishes, of game birds and mammals, as well as of forests and of other public resources of States and nations. Laws restrictive in the minutest detail have not been sufficient to entirely control. Private ownership is absolutely necessary for conservation of at least a part of the supply. In the case of game, private individuals under present laws seek to secure control of fish and game by posting their lands. These people fall into two distinct classes: (1) those seeking exclusive shooting or fishing privileges for themselves, their friends or associates; (2) the other seeking to make sanctuaries where birds may be protected, not alone during the season of propagation, but during their entire lives. On this territory not alone is the shooting of birds prohibited, but suitable nesting places and food supplies are provided. By traps and other devices, the animals which are in any degree destructive to the birds, their nests or eggs, are so far as possible reduced in numbers.

In the case of the first type, the posting of land practically secures individual possession of the fish and game, even though theoretically such practically amounts to conversion of public property, if the owner of the land maintains and uses this public asset for his private use. Such conditions have been dealt with in the case of the public timber, grazing lands, mines and water power; and, while it is true that all private rights to land, mines, etc., were originally derived from and

by the consent of the public, these have always carried, in theory at least, some compensation to the public through direct taxes. It is, therefore, worthy of consideration whether the person who thus posts his land for the purpose of securing to himself or associates exclusive rights of fishing or fowling should not be called upon to pay an adequate tax for this privilege, and whether such reservations should not be made subject to a special tax in addition to the tax placed upon the general public, collected in the ordinary hunting license. But over and above the general and special restrictive legislation there must be a considerable amount of constructive legislation, directed to the establishment of the utmost possible number of sanctuaries, or public and private reservations, where the birds are protected by every known device. Not alone should the metropolitan parks and State reservations be utilized for these purposes, but every possible assistance should be extended to associations and to private individuals who are sufficiently public-spirited to set apart land for these purposes.

Further, every practicable effort should be made to encourage the breeding of game birds, both in confinement and on wild tracts, by individuals, corporations and associations. Care should be taken, however, to have such efforts conducted by capable and responsible people, under State supervision and regulation, in order, among other things, to prevent the introduction and dissemination of contagious diseases. It is questionable to what extent the Commonwealth may be expected to maintain artificially a continuous supply of game birds which are liberated from time to time merely for the purpose of affording recreation to sportsmen. Without doubt it would be unwise to use any considerable amount of public money for the purpose of rearing game birds, unless such birds are of very considerable value in the destruction of insect pests, any more than that the State should cultivate or maintain apple and pear orchards in the public parks. Nevertheless, it is the duty of the State to ascertain and to point out the very best methods for developing and maintaining a food supply for birds, of devising and advising on the most satisfactory methods of handling wild birds under complete or semi-domestication, of making studies of the life history and the feeding

and breeding habits of the native game birds, for the purpose of establishing a system of maintaining the source of this most healthful recreation, which makes the State attractive to a large number of permanent residents and occasional visitors whose means do not permit more extensive trips for recreation in fishing and gunning. At best the annual output of game birds reared by this commission must necessarily be limited; but its value to the people is not to be reckoned in the actual number of birds liberated for the benefit of the sportsmen, but in the amount of information and valuable facts which will ultimately make possible a better understanding of the value of game birds to the community, and definite, economic methods by which the annual crop of birds in the State may be maintained and greatly increased.

We therefore urge most strongly the generous public support for the greatest possible number of sanctuaries and breeding places for wild or insectivorous birds, — quail, ruffed and pinnated grouse, — and the encouragement of all well-advised projects for rearing these birds, either in captivity or under semi-domestication. We hope to institute special experiments for the purpose of ascertaining definitely the value of pheasants as efficient destroyers of gypsy moths, by confining pheasants in a small area badly infested by gypsy moths.

Further, we definitely urge the necessity of definite quarantine regulations upon birds brought into the State for purposes of liberation. There is considerable evidence that game birds infected with dangerous infectious diseases have been brought into the State and liberated.

The report of Prof. C. F. Hodge, relative to the propagation of ruffed grouse and quail in confinement, follows: —

CLARK UNIVERSITY, WORCESTER, MASS., Nov. 27, 1908.

Dr. GEORGE W. FIELD, *Commissioner of Fisheries and Game, Boston, Mass.*

MY DEAR DR. FIELD: — Ruffed grouse were so scarce in the covers last spring that I made little effort to secure eggs of wild birds from Massachusetts, and all my attempts to have them collected from other States and from Canada proved futile. One clutch, however, of 12 eggs, was obtained and 10 chicks hatched. Of these, 3 were reared to maturity. In the loss of the 7 in this brood I encountered a new difficulty,

against which we must be on our guard in the future. Striped plant bugs were abundant on the grass, and were easily obtained by sweeping with insect nets. The young chicks ate them greedily, and simply went to sleep and died as if they had been chloroformed. These bugs had the strong odor of squash bugs, by feeding which to toads Conradi found that they died as though they had been poisoned with chloroform.

Conradi found that 5 or 6 squash bugs might be sufficient to kill a toad, and Miss Morse has fed as many as 11 to a bob-white at a single meal, with no ill effects. Plant bugs are not so strong as squash bugs, and I have observed a toad eat over 250 of them in a day without showing ill effects. Still, while this evidence is not conclusive, I did not wish to push the experiment further. With complete change of diet, fatalities ceased; no lesions of disease could be discovered in the dead chicks; but I think that we should be careful in future not to feed too many strong-smelling bugs to young grouse chicks.

Of the grouse reared last year and carried through the winter, one of the best cocks was turned over to Mr. Merrill at Wilkinsonville to breed with his hens. Only one of the flock proved to be a hen, and she laid a clutch of 12 eggs. She brooded them for about two weeks, and deserted the nest. The eggs were not allowed to become chilled before I placed them under a bantam hen. They all proved, however, to be infertile. We have held our own with the ruffed grouse this season, and gained some valuable experience. As stated under plans for next year, at the close of this letter, I hope to specialize on them next year and rear a large flock from eggs collected from widely distributed points in the range of the species.

Experiments with the bob-white have proved more interesting and successful than anything yet attempted. We began the season with five pairs and several extra cocks. The first egg was laid May 6, and four of the hens had begun laying by May 10. In all 247 eggs were laid, — an average of 49 to the pair. One hen died from a large internal tumor, after laying 36 eggs, and another was killed by accident after laying only 16 eggs. The three hens that survived the season laid respectively 69, 68 and 58 eggs, — an average of 65 eggs apiece. Mr. Merrill has reported 100 eggs laid by a bob-white hen this season. These figures suggest some of the possibilities of rapid increase of these valuable birds in domestication.

In all, 114 chicks were hatched and 75 reared. While this showing is not bad under some of the difficulties encountered, it is reasonably certain that a larger percentage of hatching can be secured another season and a much larger proportion of the chicks can undoubtedly be reared.

Great variation in habits was evinced by the different pairs of bob-whites, especially with respect to brooding and care of young. One pair was kept in the large cage with the partridges. The cage is about 40 feet square, and includes the bases of two large spruces. The quail and

grouse did not appear to interfere with each other at all. After making and filling several nests, the cock began brooding a nest with 16 eggs, August 20, hatching 15 chicks September 13. The hen made another nest on the opposite side of the enclosure and laid 3 eggs in it, and ceased laying for the season, producing 58 eggs in all. Both birds joined in the care of the brood.

Another pair, kept in a cage 6 by 12 feet, produced a succession of nestfulls of eggs, 69 in all, and neither bird showed any signs of brooding. The cock, however, reared a brood of bantam-hatched chicks, while his hen refused to associate with him as long as he had the chicks, even going so far as to roost on a perch in the top of the cage.

The third pair were kept in a cage 3 by 6 feet, and produced 68 eggs in a single well-made nest. The eggs were removed at intervals, because neither bird showed signs of brooding; but plaster of Paris eggs were placed in the nest when the others were taken out. On the 9 eggs last laid the hen began brooding September 12 and brought out 9 chicks October 6. The cock was attentive to his mate on the nest, but was seen brooding it only once, for a few minutes, while the hen was feeding. Both joined in the care of the young.

Of the two unmated cocks, one readily adopted a brood of bantam-hatched chicks and reared them with great fidelity. The other not only refused to brood chicks offered him, but pecked them savagely, and, if not prevented, would probably have killed any chicks left in his cage.

These data prove that a cage as small as 3 by 6 feet is well suited for propagation, and that there are good chances for selection of breeding stock. The pairs that brooded well and reared their young are being preserved with special care, along with their progeny, to form the breeding stock for next season's experiments.

Valuable observations were made on the brooding habit, and in this the two birds differed strangely. The cock remained on the nest continuously from 1 P.M. to 12 M., at which time he usually took about an hour off to feed and wallow. The hen usually left the nest to feed for about half an hour between 6 and 7 A.M. and between 5 and 6 in the evening; and she would slip off to feed when grasshoppers or other insect food was in sight. The weather was cold toward the last, and it seemed certain on frosty mornings that the eggs would be chilled. However, I did not meddle with her housekeeping, and she brought off all the fertile eggs.

A few preliminary observations were made on the temperature of birds, in order to gain points for artificial incubation, and it is hoped to carry out this line of study more completely next season. I did not dare risk disturbing my brooding grouse hen.

Birds.	Temperature (Degrees).	
	Internal Body.	Nest.
Ruffed grouse cock,	106.3	-
Ruffed grouse hen (not brooding),	107.3	-
Bob-white cock (brooding),	111.0	103.1
Bob-white hen (not brooding),	108.3	-
Bob-white cock (not brooding),	107.2	-
Cochin bantam (brooding),	108.0	103.0
Cochin bantam (laying),	106.4	-
Cochin bantam (laying),	107.3	-
Rhode Island Red hen (laying),	106.4	-
Rhode Island Red hen,	106.5	-
Rhode Island Red cockerell,	108.6	-

The nest temperature in case of the hen was taken at the top of the eggs in contact with the body. The bob-white persisted in either working the thermometer down under the eggs or out of the nest, so this reading does not indicate a maximal temperature.

Our indications indicate that the bob-white broods rather more continuously than we expected to find, and still they do give the eggs rather long periods of cooling once or twice a day. The remarkable temperature of the brooding cock, 111°, suggests that probably an incubator should be run 1° or 2° higher than for domestic fowls, giving rather long periods of cooling. It is proposed next year, if possible, to obtain a complete nest record — times of brooding and cooling, with body and nest temperatures, as far as practicable — for each day of the incubation period, for both the ruffed grouse and the bob-white. This will yield valuable data for artificial incubation, which, especially in view of the excess egg production of the bob-white, will greatly facilitate extensive propagation and avoidance of contagious disease.

With regard to brooder temperatures, too, it has been noted in the experience of the past two years that the bob-white and ruffed grouse chicks appear to thrive much better when the hovers are kept a good deal warmer than indicated in the directions for domestic chicks. For bob-white chicks the later part of this season I ran the hovers at least 5° warmer than the directions indicated, with apparently only favorable results. This means, in practice: First to fifth day, 100° to 105° (105° at night); fifth to fifteenth day, 95° to 100° (with not less than 100° at night); fifteenth to thirtieth day, keep the hover at 95° at night and allow the chicks to choose cooler places in the brooder, or even sleep out doors in the attached cage, if they wish. At this time the flock will often be found asleep outside in the evening, and huddled in

the warm hover after the first early feeding, if the morning is chilly. If I had followed the above plan for the entire season I feel confident that a much larger percentage of the chicks might have been reared.

In reading Bulletin No. 123 of the Rhode Island Experiment Station, on " The Rearing and the Management of Turkeys," we note how often all, or a large percentage, of the poults of any lot are recorded as dying of " brooder troubles." As with the turkeys, we thus find ourselves in the rearing of bob-white and grouse between the " devil " of blackhead disease, which is sure to kill the whole flock, if we brood with hens, and the " deep sea " of " brooder troubles," if we rear in brooders.

The first part of the season was apparently unfavorable, and only one chick was reared from about the first 100 eggs. I was obliged to be away during this time, and up to July 26.

On August 24 I received 50 bob-white chicks, hatched by Mr. Merrill from eggs sent to Wilkinsonville, and on August 31, 18 more, hatched under a bantam on the place. This lot of 68 were kept in two brooders, which had just been fumigated with sulphur after a thorough scrubbing and saturating with hot lime wash. All went well for the first week, but the temperature had not been run high enough. On about the tenth day they began dying, 24 in two days, bringing the flock down to 44. I transferred them to freshly fumigated and whitewashed brooders, in which I ran the temperature as indicated above, and made a complete change in the diet. Whenever the weather permitted, I gave them the run of the hillside, where they were active in catching grasshoppers, crickets and other insects. At about four weeks of age the two brooder flocks united while they were out foraging, and thereafter I kept them in a cage attached to the brooder. Only one died, early in November, and examination showed infection with coccidia, an undoubted case of blackhead disease. This was the only case the entire season. The others all died of " brooder troubles," which in the case of this flock I take to be acute indigestion.

In the feeding of young grouse and bob-white chicks I have had in mind from the start the necessity of variety. Their natural food consists of a ceaseless variety of different insects, fruits, seeds, leaves and so on. This is especially true of the food of the young of both species, coming as they do when nature's repast is most varied. The most careful artificial feeding of a flock in confinement cannot approach in variety the food of the wild birds; but the main lines of natural variety feeding may be followed, if their significance is appreciated. From examination of the birds as they died and the study of my flocks this season, the real meaning of " variety diet " took form in my mind about as follows: —

The birds that died of " brooder troubles " showed intestines filled with foam and intensely inflamed. They died suddenly; with no appearance of illness at night, several would be dead in the morning. This indicates acute bacterial infection, and it comes about in this way: in

a meal of rich food, custard, we will say, bacteria, which are always present in comparatively harmless numbers, multiply rapidly; a meal of the same food follows, and an explosive growth occurs which kills the bird. If, instead, a meal of some entirely different food had been given, preferably of coarse or bulky material, after a rich meal, the bacterial growth would have been swept out before it caused appreciable harm; then another meal of richer material might follow. Knowing, as we do, how sensitive bacteria are to the constitution of the culture media, and realizing how fast they can multiply if conditions are favorable, it seems to me that this theory explains all the "brooder troubles" I had this season; in fact, no loss or trouble attributable to foods occurred after this theory was consistently followed.

In practice, the feeding of a brood of bob-whites would proceed as follows. We will say that the chicks are removed from the hen as soon as dry. They are put into the hover at 105°, and the window darkened to let them sleep quietly for half a day at least. As soon as they begin to call and wander about the brooder, let in the light, sunshine if possible, and give them access to a mixture of fine grit or coarse sand, granulated bone, fine oyster shell and charcoal in equal parts, and clean water. Remove the water and leave them for two hours. Then give them, preferably, a net full of insects swept from the grass, or weeds or twigs covered with plant lice, or a trap of singed flies, or a few well-cleaned maggots. Supposing we have begun operations at noon, this will be the 2 P.M. feeding; at 4 o'clock we let them eat their fill of freshly cooked custard; at 6 give them again all the insects they will catch and eat. After a day like this we may be sure they will all be alive the next morning.

The second day at sunrise feed sour milk curd (I use it made very dry and pressed through a potato masher). At 7 to 8 o'clock put them out on the grass in a sheltered place in the sunshine to forage for themselves; and as soon as they cluster after feeding, or begin to call for help, or show signs of chilling, gather in an insect net and replace in warm hover.

To save trouble in catching and handling, I have now devised a little tray that fits exactly in the hover (of my model brooders), and closes by a hinged door which drops flat on the floor of the brooders. Thus, when the chicks go under the hover they enter this box; and if it is desired to take them out, it is only necessary to close the flap door and draw out the tray. The bottom, sides and ends are made of thin board, and the top of black woolen cloth. On warm, sunny days this "sunshine hover" may be all the chicks need for warmth. Bedding of warm, dry lawn clippings or cut clover is kept in the bottom, to facilitate cleaning and for the chicks' comfort. The whole device makes it an easy matter to keep the brooders clean. There must be no narrow cracks or chinks anywhere about the brooder or cages, into which a chick can possibly wedge itself. Ordinary brooders are never made

tight enough to hold the grouse or bob-white chicks, and at first I lost several by their creeping into the cracks over the heater or into the chink behind the block which separates the compartments. If a box is put carelessly against a wall anywhere, we are likely to find the chink full of dead and dying chicks an hour or so later.

To return to the feeding of the second day, if ground insects are abundant, the day hot and sunny and not too windy, the chicks may be allowed to forage around their hover until within an hour of sundown. A clean, shallow dish of water is kept with them. I use the glass cover of a fruit can for the first few days (I have had young chicks drown in a small tumbler), and it is filled when I go to see that they are getting along all right. It is well also to offer them a tray of maggots or meal worms or singed flies, or a dish of custard or scalded ants' eggs from time to time, to be sure they are finding food enough. At about sundown let them have their fill of any one of the above foods which has not been given before. So much if the day is bright and hot. If the day is stormy, as it is almost sure to be, they will have to be kept in a brooder. They are then fed as follows: 5 to 6 A.M., curd; 7 to 8 A.M., maggots; 10 A.M., custard; 12 M., something bulky, — berries of the season, raspberries, strawberries, elderberries, apple or grated carrots, mashed potato; 2 P.M., singed flies or meal worms or scalded ants' eggs; 4 P.M., net full of swept insects; 6 P.M., all the meal worms they will eat.

On the third day, if sunny and hot, manage like the second day, except add mixed weed seed, rice meal, corn meal or some good dry chicks' feed to their grit mixture, and be sure they have fresh green stuff, chickweed, dandelion seed heads, sorrel blossoms and seed, June grass or pigeon grass or millet heads to pick at. Offer them a tray of sifted dry loam, kept in the sun or in an oven until it is thoroughly warm. They will probably tumble into it like little ducks into water. They often use the dust bath twice and three times a day, and they should have it constantly in their home cage. I think nothing attaches them more strongly to a homing place than a warm dust bath and a constant supply of clean, fresh water.

If the weather is inclement, the third to the tenth days are practical repetitions of the second. Intervals between feeding may be stretched gradually, the rule being to feed little and often and have them good and hungry at every feed, removing all foods except the greens and grit mixture as soon as they have eaten.

From the tenth day on there should be little difficulty, so far as feeding is concerned. If kept in the brooder with cage attached, the cage can be raised at one corner, and they will go out to feed on insects and probably come home to drink and wallow. If insects are abundant on the ground, they may require no other feeding than the curd or custard, maggots or meal worms in the early morning and the last thing at night.

The little fellows have an affinity for brush patches, corn, asparagus

beds or any sort of natural cover, like that of ducks for water. Instead of proving the nuisance that I at first feared, this affinity may be turned to excellent account if properly indulged and arranged for. I always keep a little brush pile, with an armful of hay or freshly cut weeds thrown over it, in the home cage. This also attracts them to the place. If they have located in a clump of bushes or a weed patch, they are safe for the day. Should a thunder storm come up, and the birds are as tame as they should be, they can be whistled home, or an insect net be put over the entire cluster and they can be carried into the brooder. When they began to fly, in the second week, I expected to be obliged to clip their wings. I did not do this, however, and, as the sequel proved, their ability to fly is a great advantage in rearing them. Within the past few days a wind storm opened one of my cages, containing adult and young birds. Though able to fly for miles, I drove them back into the cage as easily as if they had been a flock of little chickens. During the summer the flocks would range out afoot to feed and fly home. In feeding the birds I used from the first a low whistle, in imitation of the feeding note of the chicks themselves. On coming home at noon or night the flock might be nowhere in sight, but on giving the whistle I would be assured by a chorus of eager replies, and in a moment the air would be full of whirring wings, as the flock flew in with a rush and lighted at the entrance of the cage. This might be repeated as many as a dozen times a day.

Wintering the bob-white offers no difficulty. I set the cages with the shelter end open to the south, build a brushwood pile in the middle of the cage, see that they are supplied with weed seed, grain mixture and water when snow is lacking, and keep a cabbage, a mangel wurtzel or an apple where they can pick at it. It might be well to see that the cluster is not imprisoned under the ice after a sleet storm, but the brush pile has afforded insurance against this so far. This brushwood pile is made by placing a few stout branches on the ground in a sheltered, sunny exposure, and on these pile about two feet of weeds cut before the seeds fall, — ragweed, lamb's quarter, pigweed, smartweed, wild buckwheat (chaff straw or loft sweepings would do, if weeds are not at hand); then pile on a foot or two of stout brush, which cannot be crushed down by heavy snows, and on top of this place a good thick covering of weeds. This will give the flock scratching material all winter, afford shelter from cold and storms, and protect from vermin, especially hawks, owls and cats. For bob-white in the open I think this simple winter provision would insure against winter-killing, and extend the range of the species at least several hundred miles to the north. The great value of the bird in insect and weed-seed destruction would amply repay farmers for their work.

As spring comes on, the cocks fight a good deal; but still breeders generally advise keeping several pairs in the same cage. I tried both methods this season, keeping four pairs in the same cage (6 by 12 feet)

through May and June. They laid well under these conditions, but there was so much disturbance and persecution that there was little hope of either hens or cocks beginning to brood. Each pair was then given a separate cage, and they did so much better that this plan will be generally adopted in future.

I have given the above suggestions to answer the many inquiries which have come to me as to practical methods of rearing, especially the bob-white. The methods indicated apply equally well to the ruffed grouse and possibly to the prairie chicken. In judging the results, we should bear in mind that the breeding of game birds, even by the trained game keepers in Europe, is rather difficult, and that not very large percentages of the birds hatched are brought to maturity. With our native species, further, we lack the advantage of possessing stock which has been bred and selected for some centuries past. On the whole, it seems to me that an impartial judge would say that the results of the six years' work fully warrant continuing the experiment. Six years is a short time, compared with the nearly three centuries since the settlement of the continent. We now see clearly that we must bid farewell to all our native game birds, or work out methods of propagating them.

I wish to focus effort next season especially on the ruffed grouse. I am more confident than ever before that I can now rear practically every healthy chick hatched. I wish particularly to secure unincubated eggs from widely distant points in the range of the species. The 8 sent me from Canada last year were probably fertile, but did not hatch, indicating that they need to be packed with great care in order to make the express journey safely. If I could pick my stations, I should ask for two clutches of eggs from each of the following regions: eastern Maine; Canada, well to the north; western Massachusetts, or the Adirondacks of New York, where the species is said to reach its largest size; the Allegheny or Smoky Mountains in northern Georgia, or the Carolinas; and finally, northwestern Montana, Washington or British Columbia. This would afford us an opportunity for studying regional variations in the species, differences in size and vigor, and possibly in resistance to disease, and enable us to select the best possible stock for the establishment of a suitable strain for further propagation. I have put aside all further engagements for next summer, so that I shall be able to devote my entire time to the work. I hope the sportsmen and naturalists of America will realize the opportunity presented, and join in making this not only a national but also a continental effort to insure the perpetuation of "the finest game bird that flies."

As you are already aware, this work has been carried on for the past two years under a grant from the Carnegie Institute of Washington. I now have in preparation a detailed report on "The Domestication of the Bob-white." I hope at the close of next season to have materials

for a similar monograph on the ruffed grouse. Numerous photographs have been taken with which to properly illustrate both these reports.

By the kindness of Mr. Richard E. Follett, a single pair of sharp-tailed grouse from the Saskatchewan were presented to me last May for experiments in propagation. They made themselves at home in a breeding cage, and apparently throve upon ordinary poultry grain. In trying different foods, however, I discovered that they were especially fond of clover; and after being fed on this abundantly for several days they were seen to mate, and the hen scooped out a hollow under a thick cover in the cage and began to lay. After laying 10 eggs she was found dead, and examination showed intense infection with coccidia. There were 7 more ova developed, which would indicate that the normal clutch would have been 17 eggs. The male died soon after. Five of the eggs hatched under a bantam hen, but all died from the "brooder troubles" during the first few days. I was obliged to be away from Worcester at the time, and so cannot give more exact data. The result would indicate that the species could be easily bred in confinement. I think that the birds must have been infected before coming into my possession.

I am promised eggs or breeding stock of the prairie chicken from three reliable sources, and hope to begin experiments with this most interesting and valuable species next season.

I am happy to report that, in return for past courtesies, permits and favors, help and valuable suggestion from your honored commission, I have turned back to the State for use in propagation 24 of the best bob-whites reared this year. I have also sent 5 pairs to the farm of Professor Morse at Pelham, which is being organized as a preserve for native game birds. These birds have been provided with a large cage, will be fed and protected through the winter, and will either be liberated to breed in the spring or be given a number of cages in which to breed under control. No poultry have ever been kept on this place, and it thus offers a rare opportunity for starting a flourishing colony.

Three pairs of the birds have been turned over to Dr. Emes P. Porter, and are being kept on the Hadwen estate in Worcester. Dr. Porter is making a careful study of the instincts, habits, intelligence and general psychology of the species.

I cannot close this report without acknowledging in full my great indebtedness to Mr. Arthur Merrill of the Sutton hatchery. The success of the season is very largely due to his intelligent assistance with regard to foods and general management during breeding operations. Most of our chicks, as indicated above, were also hatched at Sutton under his personal supervision.

C. F. Hodge.

The report of the superintendent of the Sutton hatchery, relative to rearing useful birds, follows: —

To the Commissioners on Fisheries and Game.

I herewith submit a report on work with quail, grouse and pheasants for the year 1908.

Practically the same problems are met with in rearing quail, ruffed grouse and pheasants, and the data secured with one can be largely applied to the work with the others.

As heretofore, the work was considered as incidental to the work of conducting the fish hatchery, and was carried on with the same force and largely on the same time, but with the disadvantage incident to the large increase in the stock of fish and the work of caring for them. This, with the increase in the work of caring for a larger number of birds, trying new methods and moving out to uninfected ground, imposed a burden that made it impossible to secure the exact data so valuable at this stage of the undertaking. Several accidents seriously impaired the value of the season's work. However, the net results showed a very marked advance, notably (1) in the determination of the most serious diseases likely to be met with, (2) in further demonstrating the adaptability of the quail and grouse to domestication, and (3) in definitely establishing the fact that disease rather than method of feeding is the controlling factor in rearing the young.

In the work of the previous season it was shown that disease was transmitted by intestinal parasites, supposedly from infected ground, and that such infected ground was unsafe for a period as yet undetermined. The presence of additional diseases was noted, though the agent was not demonstrated. More recent information points to infectious diseases of the lungs and intestines of the type more or less familiar to those engaged in brooder work.

The agency of poultry in transmitting dangerous intestinal parasites directly and through other birds is well established, but it does not appear that these diseases are solely transmitted by or from poultry. They have appeared when previously healthy lots were grown in the brooders, and the conditions were decidedly unfavorable for direct transmission.

From a more extensive pathological examination of dead birds examined in a fresh condition, it was determined that the loss of young birds from what was suggestive of an intestinal disturbance, due to the food given, was caused by a bacterial infection. The loss from this disease appears to have been confined largely to young birds, generally under one week, or, if older, birds that appeared weaker and having less resisting power. The loss was more general among brooder birds, and especially in some lots where disinfection was uncertain from methods or disinfectant agent used. It was not established that this disease caused any loss under hens. The grouse so grown that were examined showed another disease, and of the quail placed under hens, the loss was very slight from any cause. It was found that in using

brooders the most thorough disinfection (as detailed later) would keep the disease in check, and as the young birds grown under hens seem generally immune, it is reasonably certain that the infection can be kept under control. It appears very probable, and may later be established, that this infection is only fatal to birds that have slight resisting power, such as young birds weakened in the brooders or those that have developed weakness in hatching. The value of the disinfection that was so successful in the late lots seems to have been largely instrumental in keeping them free from attack until they have gained sufficient strength to be practically immune.

The lung disease, a "brooder pneumonia," was produced by a mold infection, which could with equal probability be attributed to conditions in the brooder at that time or to previous uses, but very likely both, and developed through dampness or unfavorable temperature. This infection, like the bacterial disease previously mentioned, is probably rather generally distributed, and its control is largely a matter of developing the resisting power of the birds. Disinfecting the brooder and all it contains, and possibly sterilizing such food as is likely to convey infection, will serve to keep it in check until the birds have gained such strength that its introduction would have no ill effect. That this is not an exclusively brooder disease is shown by its presence in birds that were not kept in brooders.

Some young grouse seven weeks old were lost under conditions that suggested infection from hens, and a careful examination was made for the parasite *Coccidium* or *Amœba,* with negative results, the cause of death being shown to be a bacterial infection producing intestinal lesions similar to those in the Alabama quail disease. The birds were reared under hens, but had been removed to coops on fresh ground four weeks previously.

In three instances this disease appeared among the birds at an interval of four weeks after they were taken from the hens, and when they were seven weeks old, indicating either that a period of four weeks or more was required for the incubation of the disease, or that the birds carried the infection until they were weakened by moulting.

This did not appear among brooder birds, with the exception of one quail, and did not appear among quail grown under hens under conditions exactly similar to which the grouse were subjected. Three hens having thirty-eight young quail lost only one, and it must be believed that these birds were exposed to this disease, also to the bacterial infection that was noted among young birds in brooders, but that conditions were more favorable for resisting it.

In the case of some winter loss, where infection was suspected, examination showed that the birds died of lung congestion, due to weather conditions. Should this loss occur again, it will indicate the need of different quarters for winter, with more protection against dampness than cold, as this loss occurred during some very wet winter weather.

The parasite *Coccidium* was found in the examination of some adult birds, with indications of it in some younger ones, but it would require a close examination of fresh subjects to prove that it caused any loss among the young birds. Where it was clearly demonstrated as the cause, the disease produced was chronic, the birds showing obvious indications of illness and dying in very poor flesh. The season's work seems to justify the belief that it is not an extremely difficult matter to disinfect pens, and only occasional loss from *Coccidiosis* may be expected. In some cases, even though there were indications of *Coccidium,* or its presence was demonstrated, bacteria were also found, and were the evident cause of death, producing an acute disease, the birds showing no appearance of illness and no loss of flesh.

The brood stock was only slightly affected by disease, *Coccidiosis* being reported wherever examination was made. In one case a tumor was found on the ovary, this bird being the female that laid 100 eggs.

With the recognition that disease was the really serious problem to solve, the season's work turned largely to practical methods of handling the birds, that would at the same time permit absolutely healthy conditions to be maintained. It was suspected that disease was carried in dust blown from the hen yards, and as there was an evident limit to moving the coops and brooders back into the woods, small coops were filled with fresh loam, seeded to grass, clover, buckwheat and lettuce, and were used when the vegetation was from one to two inches high. This gave entire satisfaction, and possessed the great advantage of keeping the broods close and under better control, — an important consideration, as it is a yet unsettled question what temperature is most favorable for the birds or what is fatal. Probably in the case of grouse or quail any very moderate drop is harmful, — 70° was known to be fatal in one case. The characteristic congestion of the blood vessels and organs was ascertained from examination of one lot known to be chilled, and this condition was regarded as indicating the cause of loss in some other lots not known to be chilled, and believed to have been scattered by a panic in the brooder during the night, some of them staying in the colder parts.

This liability to panics seems more characteristic of quail than of grouse or pheasants. In some instances here grown quail have beaten themselves to death in the night, and younger birds have left the brooder in a storm, to perish from the drenching received outside. In the night inspection of the brooders it is a common occurrence to find the young birds scattered, when the previous examination had shown them bunched in the proper place. It is also noted that, unlike grouse and pheasants, quail when very young cannot be relied upon to seek heat when necessary, and they are frequently found hidden outside day or night when the weather conditions were unfavorable for them.

In raising birds under hens, already referred to, the hens were kept in a box and given food and water on a shelf out of reach of the chicks.

and the chicks were fed and watered in the yard outside, readily seeking their food where it was placed and returning to the hen when necessary for warmth, though often preferring the warmth of the sun outside.

The best method of disinfecting the brooders and pens is a matter to be settled in detail in the future, but it is evident that only the most thorough work is of use. In the breeding pens the use of lime was effective; and where this could not be extensively used, as in some of the large pens, or those that drained into the trout ponds, good results were obtained by burning the grass and brush, the sunlight getting into the previously shaded pen being no small aid. To sterilize the brooders by swabbing the interior with disinfectant was found to be ineffective, the manner of construction making numerous crevices where the infecting organisms remained untouched. Eventually the practice followed was to scrub the brooder out thoroughly, disinfect it with formalin, then fumigate it, together with the dust and bedding of pine needles, with sulphur. This practice will be followed unless varied through more extended experience in the future, and in addition the brooder will be enclosed in a tight box or covered with canvas, to make the fumigation more effective and to save surrounding vegetation.

As to the effect of disease and confinement on young birds, it appears that pheasants, quail and grouse are hardy in the order named; but each year information gained in working with the early hatched grouse has been applied with evident benefit to the quail and pheasants hatched later. In the case of the adult birds the experience of three years indicates that the grouse is quite equal to the pheasant in ability to thrive in confinement, though it is yet to be determined how well it may breed. However, the results so far are encouraging. The quail may possibly prove to be more susceptible to disease than the pheasant, but, as developed at present, is superior as a pen bird, quite as prolific, and adapts itself to all conditions as to size of pens and surroundings.

Of a series of pens containing both wild and pen-grown birds, the average number of eggs laid was 38, which is threefold the first year's average. The present record is held by a bird that laid 100 eggs, beginning April 18 and finishing about September 12. All of these eggs were well fertilized, and when it became evident that she was laying an unusual number, they were tested with care, the last 43 laid testing 42 fertile. From the last 24 laid, hatching in September and October, 20 were hatched and 14 reared. This prolificness certainly did not result in infertile eggs or in impaired vitality in the chicks, and is an effective demonstration of the breeding capacity of captive quail, and of the value of small pens, as the pen containing this bird was but 12 feet square, and had but a slight amount of vegetation.

During the season of 1906 several pens were kept with two females to one cock or three females to two cocks, and many infertile eggs were noted, occasionally a nestful testing all infertile. This at the time was attributed to the eggs laying in the nests undiscovered until spoiled.

During the next year all the eggs were well fertilized, the birds being paired, except one pen that contained two hens and one cock. Of the 74 eggs taken from this pen 37 were infertile. The fact that during the present season some eggs were known to lie as long as did the suspected ones in 1906, and yet hatched well, is evidence that the cause of the infertility then was the failure of the cocks to mate with the extra hens. Therefore the best practice is to pair all birds, but it is yet to be established by sufficient tests whether more than one pair of birds will mate in an ordinary breeding pen.

During the present season no quail failed to lay, and only one laid a noticeably small number of eggs. This was a wild bird, captured outside of the pens early in the spring. A wild Alabama female, the only one that failed to lay the previous season, nested three times, laying 39 eggs. She showed a decided tendency to incubate her eggs, and hatched out two broods, nesting in both cases where she could be freely observed and closely approached by visitors. The second brood was hatched in October, and on account of the lateness of the season the mother and chicks were placed in a brooder, where she successfully reared a portion of the flock.

Another lot of birds that hatched the same day were placed with the male in another brooder. He promptly adopted them and was very successful in rearing them.

This male while in the pen with the female was never seen on or near the nest, but when the chicks hatched he was very active in caring for them. In a nearby pen a male undertook to incubate some eggs without aid from the female, but abandoned them before they were quite ready to hatch.

In the earlier attempt at hatching quail, considerable loss was experienced through breakage of eggs, and it was considered unavoidable at the time, if hens were used, owing to the fragility of the shell, and the following season incubators were used, with some success, hatching 80 per cent., but at the same time the work with hens showed a decided improvement. During the present season work with incubators has been unsatisfactory, except where eggs were finished after partial incubation under hens. The hens gave entire satisfaction, the greater number breaking no eggs. This improvement resulted from a more careful selection of hens, older and quieter ones being preferred.

It will require much additional data before the very best method of feeding can be definitely laid down; but what was secured this season largely confirms the previously formed opinion that there is no great difficulty in providing food for the birds, and the care of them does not necessitate the exact attention held to be so important at first. With the conclusion that the loss of birds from intestinal disorders was due to specific diseases, and not to errors in feeding, simpler methods were tried, and the tests showed most satisfactory results. The several lots grown with little or no loss were those given the most restricted

quarters and with no insect food. The practice that was concluded to be the most successful was to feed with ant eggs, maggots, berries and green food, and dry food of mixed grain, seeds, bread crumbs and meat scrap, with some cereal preparations. Shredded wheat was the best; shredded wheat was also used in the custard that was fed largely to the pheasants. Made in the proportions of one egg to one biscuit, with enough milk added to give it a good consistency for feeding, it appeared to be more satisfactory than the ordinary thick custard used.

In feeding, a proper rotation was followed; but as far as possible the food was kept before the birds, they being allowed to eat whenever they chose, which resulted in small amounts taken frequently. The most necessary precaution to follow was to renew the food before it could possibly become stale.

The relative value of the various sizes of pens tried was not settled definitely, but for young chicks it did not appear that the large pens had any decided advantage over the small ones. The birds found some insect food, but this was quickly exhausted; the supply of green food lasted longer, but a satisfactory supply can be fed to the birds in any pen.

The added vigor in pheasants that had a measure of liberty could not be noted in the other birds; and it could not be claimed, as between large and small pens, that one had an advantage over the other in producing vigorous birds; but it is not improbable that quail and perhaps grouse can be allowed to run free at certain ages, and if this proves to be so, there will be no occasion to use anything but a small pen. The wholly different habits of the pheasants, however, make roomy pens a necessity if any number of birds are to be kept together. For wintering quail and grouse small pens have given entire satisfaction except in the accumulating waste and snow that results in foul pens when the snow melts. Smaller pens, that could be kept wholly dry, but open to fresh air, would be better. These could be adapted to some extent from existing buildings. It has been noted that breeding is entirely satisfactory in small pens when the birds are fairly tame, and it may be assumed that these are best for use except when trapped birds are added to the stock. These, to breed without long delay, would require large pens well filled with brush; and it is yet to be determined if the larger pens are not necessary for grouse, especially for the safety of the female in mating.

The year's work with pheasants showed a largely increased number, raised with only a moderate increase in the equipment or brood stock. The use of hens for hatching and rearing was continued, incubators and brooders being used experimentally, as the equipment could handle only a small part of the eggs and chicks. The incubators were used mainly to finish the eggs partly incubated by hens, saving the loss of some chicks killed in hatching, and all loss by vicious hens, besides giving opportunity to clean the hens of lice. The use of

brooders, as was the case the year before, was very satisfactory, especially when managed in the way found necessary for getting good results with quail. Then the loss of young chicks was only the apparently weak and crippled ones.

The work with hens was so far improved as to be nearly equal to that with brooders, on the average, and somewhat better with a few lots placed out in the sprout land and allowed to run free in the underbrush. These birds, after a few days, were not confined day or night, and the loss from unknown causes was so slight as to make it certain that they were not molested by any enemies. The thick growth of huckleberry bushes, sumach and sweet fern made the best possible protection against birds, but a fox, cat or snake would rather find this an aid, and if they molest lots so placed in the future the area worked should be large enough to place the successive lots far apart. These birds were moved into the pens when three weeks old, and showed a more vigorous growth there than the incubator birds. One lot that was much below the average of the others in healthiness was placed under hens on open grass land, and lost 30 per cent. of its number between the second and third weeks, the birds that died showing indications of *Coccidiosis.* There is no suspicion of the ground these birds lived on, and disease must have been transmitted from the hens they were with, and the reason this exceptional case occurred among many, may indicate that hens infected with and distributing *Coccidia* freely are exceptional. This lot of birds was taken from the hens, placed in a pen and treated, with the result that no further loss occurred.

It is possible that with thorough treatment and change of conditions previous to being used for setting, the hens may be more or less freed from infectious disease germs, and in so much tend to reduce the danger to the chicks from infections from this source. This will be attempted with the regular stock of hens, and a special stock is being grown from the shell under the best conditions for keeping them free from disease.

The results of the propagation of game birds is sufficiently encouraging to justify urgent recommendations for putting it on a better footing. The results should not be dependent on the exigencies of the hatchery work, to be carried on with a fair measure of attention when the hatchery work can be curtailed, or with the least that can be given when the hatchery work is pressing and cannot be cut without danger of impairing the result in eggs and fish.

It would be better, until data are collected to determine the routine necessary to follow, to have this work done apart from the ordinary hatchery work, and, as it is doubtful if the results desired would be reached with ordinary labor, the services of a special investigator should be secured to carry on that part relating to breeding, hatching and rearing, so that whatever investigation was undertaken, it could

be carried on in detail, and on such a scale that satisfactory conclusions could be speedily reached.

Some of the more important points are suggested below.

The breeding quail should be closely watched in their mating and nesting, — a field of observation only slightly covered. The question as to whether a male will mate with more than one female when they are in a pen together cannot be considered settled by the limited data recorded, and, further, the question as to how many pair will mate in the same pen is of considerable importance in the breeding work.

The breeding of grouse is a particularly vexatious problem, owing to the uncertain temper of the male. It will require a large measure of close attention to develop a reasonably safe practice for handling them in small pens, or note their behavior in a pen large enough to be safe for the female. The fecundity of individual birds should be further investigated and developed. This will require a great deal of work in keeping exact records of the eggs as laid, percentage of fertilized and hatched; and to carry this to the proper end, the birds may be reared in separate lots, so that advantageous selections may be made for future breeding.

The conditions under which birds will breed calls for study, to know by what arrangement this can be brought about when it is desirable. The action of quail so far has been very erratic; they have abandoned their nests, partly incubated, nearly as often as they have finished incubation, and have not as a rule attempted incubation at all, the tendency each year being more to continuous laying. The grouse have shown more inclination to incubate, and have so far failed to continue laying when eggs were taken from them.

The problem of hatching appears to be more nearly worked out, but much remains to be done with incubators, especially in the matter of regulating the moisture supply, airing and cooling. To perfect the methods of rearing young requires extensive comparative feeding tests, the end sought being to care for the birds with no excessive expenditure of time, as would be the case if reliance must be placed largely upon insect food, or a routine, calling for constant attention, followed. Substitutes for insect food should be tested, carrying further the trials already made, which indicate that maggots and dried ant eggs are sufficient. It should be decided if these are necessary, or if milk or egg foods can be substituted to the exclusion of one or both.

The feeding tests should show, in connection with bacteriological work, to what extent development of pathogenic bacteria in chicks is due to outside infection, through air, water or food; whether these bacteria act directly upon the tissues, or whether they multiply upon the food as a medium, and liberate chemical substances which ultimately kill the bird. Can such a condition be controlled by a proper selection or rotation of food?

Bacteriological work should be carried on at the laboratory, as the

difficulty in getting subjects examined in fresh condition has delayed the establishment of certain facts, and the work is far from being complete. It would aid the work to have preliminary examinations made here, referring to eminent authorities cases that seem proper subjects for future examination.

The brood stock for future work is largely increased and is well proportioned, there being an excess of females for the first time.

The stock loaned Dr. Hodge was returned in an increased number of young birds, but as this does not add new blood, which will be very desirable in the near future, it seems an appropriate time to provide for it by securing a stock of wild birds while there is ample equipment of movable pens for quarantine purposes and large pens for breeding. It would be a very material aid in getting the work of rearing game birds established on a definite basis to have it taken up at other places, and under diverse conditions. The facilities offered at Springfield by the park commission have been investigated and everything appears most favorable for success. Some of the birds on hand are so domesticated that they would hardly fail to breed wherever put, and there the work would be done under conditions distinctly valuable for extending it.

Detail of Quail Eggs hatched in 1908.

[The 100 total is included in the 470 total.]

Date of Hatching.	Number.	Laid by One Hen.	Hatched.	Remarks.
June 13,	18	18	8	Hatched under hen, 2 broken, 8 probably infertile. Eventually all lost, but 2 lived to age of two months.
27,	13	5	11	Hatched under hen, none broken; 2 chicks died in hatching; chicks kept under hen; 2 escaped. No loss while with hen, 1 several weeks after being taken away.
July 7,	20	-	13	Seven died in one brooder, imperfectly disinfected eggs; 6 in other brooder; 3 escaped, 3 survived.
7,	40	-	12	Twelve broken, mostly under one hen; 7 kept under one hen; 1 lived. Five put with some of Dr. Hodge's that hatched same time.
7,	23	12	5	In incubator chicks died quickly after hatching.
12,	40	-	30	Twelve under one hen, all saved; 18 in brooder, 12 saved; partial loss in both lots late in August through accidental overdose of cholera cure.
19,	32	10	-	In incubator; hatched under hen.
26,	20	-	18	In brooder; lost mainly through chilling; some stayed out in grass till found after dark; others left brooder in storm.
26,	20	-	19	Hatched under hen kept in brooder; 13 on hand, when mostly lost, like lots of July 12.
26,	19	-	19	Hatched and kept under hen; all alive until loss by snake, and August accident left 2.
Aug. 1,	52	12	5	In incubator one-half period, finished under hens, 2 survived until lost in August.
11,	11	-	6	Hatched by female quail; lost lot in August through accident.
17,	24	-	-	Under hen, 4 infertile; placed in incubator to hatch; lost through overheating.

Detail of Quail Eggs hatched in 1908 — Concluded.

Date of Hatching.	Number.	Laid by One Hen.	Hatched.	Remarks.
Aug. 21,	19	19	16	Hatched under hens; placed in brooder; raided by ants; removed second night; put with next lot.
21,	35	-	14	This and preceeding lot in incubator one week, then put under hens: lots united and mostly lost by accidental chilling.
Sept. 8,	14	14	11	All fertile; 3 lost in hatching, 8 reared in brooder.
8,	32	-	13	Hatched under hen kept in brooder; 3 escaped; others lost by chilling and staying close in brooder.
18,	8	-	8	Hatched under and killed by hen.
Oct. 7,	10	10	9	Hatched under hen; placed in brooder with male; 6 reared.
7,	10	-	5	Hatched in pen by female quail, then placed in brooder; 2 reared.
7,	10	-	-	Spoiled eggs found in pen.
Total,	470	100	222	

Detail of Pheasant Eggs hatched, 1908.

Date.	Old Stock.		Whitin's Stock.		Remarks.
	Eggs.	Hatched.	Eggs.	Hatched.	
May 24, . .	104	13	-	-	It was not practicable to follow the details of the pheasant chicks, and only the totals can be given.
31, . .	124	38	95	37	
June 11, . .	100	33	-	-	
19, . .	140	60	100	67	
28, . .	175	83	48	8	
July 8, . .	160	95	-	-	
16, . .	-	-	124	52	
24, . .	204	80	-	-	
Aug. 1, . .	126	35	90	25	
24, . .	92	28	60	12	
Total, . .	1,225	465	517	201	

Number liberated in the spring,	36	
Number liberated in the summer and fall,	330	
Number preserved for increasing stock,	70	
		436
Less old birds liberated in the spring,	36	
Less old birds liberated in the fall,	12	
		48
Young birds raised during season of 1908,		388

Detail of Grouse Eggs hatched.

Received.	Hatched.	Number. Received.	Number. Hatched.	Deputy.	Town.	Remarks.
May 6,	June 2,	11	11	Ruberg, .	Gill, . .	All lots were lost under one week except where noted.
12,	May —,	9	5	Putnam, .	Auburn, .	
15,	June 6,	13	12	Mills, .	Shirley, . .	Hatched by Mr. Coffin.
16,	8,	9	6	Dineen, .	Easthampton,	
16,	4,	11	6	Zeigler, .	Sheffield, .	Placed under hen; 2 raised to seven weeks.
18,	11,	13	10	Shea, .	Prescott, .	Placed under hen; 5 raised to seven weeks.
18,	3,	13	10	Converse,	Leominster, .	
20,	1,	13	13	Putnam, .	Spencer, .	Two of this lot were saved and are on hand now.
21,	4,	14	11	Zeigler, .	Pittsfield, .	
25,	May 28,	13	10	Leonard,	Sharon, . .	
28,	June 3,	13	11	Bemis, .	Marlborough,	
June 1,	1,	10	10	Smith, .	Chester, . .	All lost second week.
18,	20,	8	7	S. C. Weir,	Sutton, . .	Placed under hen; 4 kept until seventh week.
Total,	. . .	150	122			

It is shown by the detail that the grouse eggs hatched very well as a rule. The failures were about equally due to three causes, infertile eggs, broken eggs and dead embryos. Further work with grouse lies in doing the hatching so the vigor of the chicks will not be impaired, and in perfecting methods of rearing.

The pheasants, as has been the case for several years, showed poor hatching, poorer than usual this year on account of the failure of many lots in the incubators, but no lot under hens or in incubators hatched satisfactorily. What examinations have been made have shown it to be owing more largely to embryos dying in the shells than to infertility. Both causes should be studied, as both can doubtless to a large extent be remedied.

Thirty-eight per cent. of the pheasants hatched, as compared with 50 per cent. last year; then about 30 per cent. of the hatched birds were reared, this year nearly 60 per cent. The number of birds reared per 100 eggs was 22, last year 15, the year previous to that 5; thus it may be seen that while the improvement in hatching and rearing is considerable, there is opportunity for even more.

It will be seen by an examination of the detail of quail hatching that the hatching in many cases was very good; the most of the poor lots were due to the use of incubators. Where incubators were used mainly the number hatched was 10 per cent. of the eggs; where hens were used mainly 65 per cent. were hatched. The number of chicks

lost by unavoidable disease was much less than the loss by unavoidable accident; this loss included 20 eggs, 45 young chicks and 45 well-grown chicks.

The number raised and on hand is 34, — 10 males, 16 females and 8 undetermined young; 8 males and 16 females received from Dr. Hodge are on hand, and 18 males, 8 females of the old breeding stock.

Respectfully submitted, ARTHUR MERRILL.

Enforcement of Law.

The fish and game laws have been enforced this year by twenty-four paid deputies, and we hope before another year to report an extension of the paid deputy service, through a plan which is now under advisement, whereby each of these twenty-four deputies is made more directly responsible for the conditions in his respective district, and secure for him the aid of the necessary number of assistant deputies, who under a nominal salary can be depended upon to give efficient and unprejudiced service.

The names and locations of these paid deputies, together with the tentative districts covered by each, are given below: —

Deputy Fish and Game Commissioners, with the Number of their Districts and Residences.

Assigned to District —	Name.	Residence.	Telephone Number.
No. 1,	Everett B. Mecarta,	Harwich,	36-4.
No. 2,	Samuel J. Lowe,	New Bedford,	761-2.
No. 3,	Allen A. David,	Taunton,	966-1.
No. 4,	Charles E. Tribou,	Brockton,	2101.
No. 5,	William H. Leonard,	Foxborough,	9-4.
No. 6,	William W. Nixon,[1]	Cambridge,	466-2.
	Benjamin A. Foster,[1]	Dorchester,	-
	Orrin C. Bourne,[1]	Malden,	1071-4.
No. 7,	Edward J. Cogan,	Gloucester,	348-L.
No. 8,	Thomas L. Burney,	Lynn,	1613-13.
No. 9,	Walter A. Larkin,	Andover,	172-5.
No. 10,	James I. Mills,	Ayer,	51-2.
No. 11,	James E. Bemis,	South Framingham,	226-J.
No. 12,	Irving O. Converse,	Fitchburg,	53-14.
No. 13,	A. D. Putnam,	Spencer,	75-4 or 75-6.

[1] Central office, Room 158, State House.

Deputy Fish and Game Commissioners, etc. — Concluded.

Assigned to District —	Name.	Residence.	Telephone Number.
No. 14,	John F. Luman,	Palmer,	17-5.
No. 15,	Dennis F. Shea,	Ware,	132.
No. 16,	James P. Hatch,	Springfield,	2571-3.
No. 17,	Lyman E. Ruberg,	Greenfield,	376-R.
No. 18,	Arthur M. Nichols,	North Adams,	391-12.
No. 19,	Fred R. Zeigler,	Pittsfield,	362-11.
No. 20,	DeWitt Smith,	Great Barrington,	72-6.
No. 21,	Charles L. Savery,	West Tisbury,	–

List of Cities and Towns included in Each Tentative District assigned to Deputy Fish and Game Commissioner.

District No. 1.

Deputy Everett B. Mecarta, Harwich.

Telephone, 36-4.

Barnstable.
Bourne.
Brewster.
Chatham.
Dennis.
Eastham.
Falmouth.
Gosnold.
Harwich.
Mashpee.
Orleans.
Provincetown.
Sandwich.
Truro.
Wellfleet.
Yarmouth.

District No. 2.

Deputy Samuel J. Lowe, New Bedford.

Telephone, 761-2.

Acushnet.
Dartmouth.
Fairhaven.
Fall River.
Freetown.
New Bedford.
Mattapoisett.
Marion.
Rochester
Wareham.
Westport.

District No. 3.

Deputy Allen A. David, Taunton.

Telephone, 966-1.

Attleborough.
Berkley.
Bridgewater.
Carver.
Dighton.
Easton.
Lakeville.
Mansfield.
Middleborough.
North Attleborough.
Norton.
Raynham.
Rehoboth.
Seekonk.
Somerset.
Swansea.
Taunton.

District No. 4.

Deputy Charles E. Tribou, Brockton.

Telephone, 2101.

Abington.
Avon.
Braintree.
Brockton.
Cohasset.
Duxbury.
East Bridgewater.
Halifax.
Hanover.
Hanson.
Hingham.
Holbrook.
Hull.
Kingston.
Marshfield.
Norwell.
Pembroke.
Plymouth.
Plympton.
Rockland.
Scituate.
West Bridgewater.
Weymouth.
Whitman.

District No. 5.

Deputy WILLIAM H. LEONARD, East Foxborough.

Telephone, Foxborough 9-4.

Bellingham.
Canton.
Dedham.
Dover.
Foxborough.
Franklin.
Medfield.
Needham.
Norfolk.
Norwood.
Plainfield.
Randolph.
Sharon.
Stoughton.
Walpole.
Westwood.
Wrentham.

District No. 6.

Deputy Chief, WILLIAM W. NIXON, Central Office, State House.

Deputies BENJAMIN A. FOSTER and ORRIN C. BOURNE, assigned to launch "Egret" and special duty.

Arlington.
Belmont.
Boston.
Brookline.
Cambridge.
Chelsea.
Everett.
Hyde Park.
Milton.
Quincy.
Revere.
Somerville.
Watertown.
Winthrop.

District No. 7.

Deputy EDWARD J. COGAN, Gloucester.

Telephone, 348-L.

Amesbury.
Essex.
Gloucester.
Hamilton.
Ipswich.
Manchester.
Merrimac.
Newbury.
Newburyport.
Rockport.
Rowley.
Salisbury.
Topsfield.
Wenham.
West Newbury.

District No. 8.

Deputy THOMAS L. BURNEY, Lynn.

Telephone, 1613-13.

Beverly.
Danvers.
Lynn.
Lynnfield.
Malden.
Marblehead.
Medford.
Melrose.
Middleton.
Nahant.
Peabody.
Salem.
Saugus.
Stoneham.
Swampscott.
Wakefield.
Winchester.
Woburn.

District No. 9.

Deputy WALTER A. LARKIN, Andover.

Telephone 172-5.

Andover.
Bedford.
Billerica.
Boxford.
Burlington.
Chelmsford.
Dracut.
Georgetown.
Groveland.
Haverhill.
Lawrence.
Lexington.
Lowell.
Methuen.
North Andover.
North Reading.
Reading.
Tewksbury.
Wilmington.

District No. 10.

Deputy JAMES I. MILLS, Ayer.

Telephone 51-2.

Acton.
Ashby.
Ayer.
Berlin.
Bolton.
Boxborough.
Carlisle.
Concord.
Dunstable.
Groton.
Harvard.
Hudson.
Littleton.
Maynard.
Pepperell.
Shirley.
Stow.
Townsend.
Tyngsborough.
Westford.

District No. 11.

Deputy James E. Bemis, South Framingham.

Telephone 2126-J.

Ashland.	Marlborough.	Sherborn.
Blackstone.	Medway.	Southborough.
Framingham.	Mendon.	Sudbury.
Holliston.	Milford.	Waltham.
Hopedale.	Millis.	Wayland.
Hopkinton.	Natick.	Wellesley.
Lincoln.	Newton.	Weston.

District No. 12.

Deputy Irving O. Converse, Fitchburg.

Telephone, 53-14.

Ashburnham.	Lancaster.	Royalston.
Athol.	Leominster.	Rutland.
Clinton.	Lunenburg.	Sterling.
Fitchburg.	Petersham.	Templeton.
Gardner.	Phillipston.	Westminster.
Hubbardston.	Princeton.	Winchendon.

District No. 13.

Deputy A. D. Putnam, Spencer.

Telephone, 75-4 or 75-6.

Auburn.	Northborough.	Upton.
Boylston.	Northbridge.	Uxbridge.
Douglas.	North Brookfield.	West Boylston.
Grafton.	Paxton.	Westborough.
Holden.	Shrewsbury.	Worcester.
Leicester.	Spencer.	
Millbury.	Sutton.	

District No. 14.

Deputy John F. Luman, Palmer.

Telephone, 17-5.

Brimfield.	Ludlow.	Wales.
Brookfield.	Monson.	Warren.
Charlton.	Oxford.	Webster.
Dudley.	Palmer.	West Brookfield.
Hampden.	Southbridge.	Wilbraham.
Holland.	Sturbridge.	

District No. 15.

Deputy Dennis F. Shea, Ware.

Telephone, 132.

Amherst.	Hadley.	Prescott.
Barre.	Hardwick.	South Hadley.
Belchertown.	Leverett.	Shutesbury.
Dana.	New Braintree.	Sunderland.
Enfield.	New Salem.	Ware.
Granby.	Oakham.	
Greenwich.	Pelham.	

DISTRICT NO. 16.

Deputy JAMES P. HATCH, Springfield.

Telephone, 2571-3.

Agawam.	Holyoke.	Springfield.
Blandford.	Longmeadow.	Westfield.
Chesterfield.	Montgomery.	Westhampton.
Chicopee.	Northampton.	West Springfield.
East Longmeadow.	Russell.	Williamsburg.
Easthampton.	Southampton.	
Granville.	Southwick.	

DISTRICT NO. 17.

Deputy LYMAN E. RUBERG, Greenfield.

Telephone, 376-R.

Ashfield.	Erving.	Northfield.
Bernardston.	Gill.	Orange.
Buckland.	Greenfield.	Shelburne.
Colrain.	Hatfield.	Warwick.
Conway.	Leyden.	Wendell.
Deerfield.	Montague.	Whately.

DISTRICT NO. 18.

Deputy ARTHUR M. NICHOLS, North Adams.

Telephone, 391-12.

Adams.	Hawley.	Rowe.
Charlemont.	Heath.	Savoy.
Cheshire.	Monroe.	Williamstown.
Clarksburg.	New Ashford.	Windsor.
Florida.	North Adams.	
Hancock.	Plainfield.	

DISTRICT NO. 19.

Deputy FRED R. ZEIGLER, Pittsfield.

Telephone, 362-11.

Chester.	Huntington.	Peru.
Cummington.	Lanesborough.	Pittsfield.
Dalton.	Lee.	Richmond.
Goshen.	Lenox.	Washington.
Hinsdale.	Middlefield.	Worthington.

DISTRICT NO. 20.

Deputy DEWITT SMITH, Great Barrington.

Telephone, 72-6.

Alford.	Mount Washington.	Stockbridge.
Becket.	New Marlborough.	Tyringham.
Egremont.	Otis.	West Stockbridge.
Great Barrington.	Sandisfield.	Tolland.
Monterey.	Sheffield.	

DISTRICT NO. 21.

Deputy CHARLES L. SAVERY, West Tisbury.

Chilmark.	Gay Head.	Tisbury.
Edgartown.	Oak Bluffs.	

Comparative Table of Law Enforcement for Years 1907 and 1908.

Items.	1907.	1908.
Total fines imposed,	$3,470 20	$7,097 50
Fines from arrests by paid deputies,	1,921 20	6,348 50
Fines from arrests by unpaid deputies,	1,549 00	759 00
Total counts taken to court,	390	472
Total number of persons arrested,	358	455
Convictions,[1]	327	424
Discharged,	56	45
Defaulted,	7	2
Cases filed,	63	77

[1] One case pending (1908) on which no decision has been rendered.

Classification of Arrests during the Year 1908.

Form of Violation.	Number of Counts.
Shellfish laws, section 114, chapter 91, Revised Laws,	78
Hunting on Lord's day,	45
Aliens hunting without license,	30
Illegal possession of game,	19
Using over ten hooks on ponds, etc.,	8
Fishing on closed ponds,	30
Possession of short lobsters,	17
Possession of short trout,	11
Killing song or insectivorous birds,	13
Possession of prohibited feathers for millinery purposes,	54
Dogs chasing deer,	2
Killing, hunting or wounding deer,	15
Setting forest fires,	8
Hunting with ferret,	11
Taking short pickerel,	9
Taking short bass,	13
Seining for smelts,	2
Smelts in close season,	10
Violation of chapter 401, Acts of 1855,	4
Having trout out of season,	2
Taking trout with net,	1
Setting net in pond,	2

Classification of Arrests during the Year 1908 — Concluded.

Form of Violation.	Number of Counts.
Seining in violation of chapter 91, section 42, Revised Laws,	3
Pollution of stream by sawdust,	1
Spearing fish,	1
Having egg-bearing lobsters for sale,	3
Torching herring within prohibited waters,	10
Using over one hook on stocked pond,	19
Trapping fish, section 132, chapter 91, Revised Laws,	1
Having unmarked lobster car,	2
Capturing eagle,	3
Setting net,	2
Setting lobster traps, section 92, chapter 91, Revised Laws,	8
Setting nets in Buzzards Bay, section 122, chapter 91, Revised Laws,	2
Taking eggs of birds protected by law,	1
Refusing to show game in possession,	1
Killing bittern or heron,	3
Having scallops in close season,	1
Using set line,	2
Taking fish with sweep seine,	4
Pursuing wild fowl with power boat,	5
Sending game birds out of State,	1
Hunting out of season,	1
Using 1½ inch mesh seine in Plum Island Sound,	5
Non-resident hunting without license,	1
Snaring game,	1
Hunting pheasants,	2
Having seed scallops,	5
	472

Number of Packages of Game in Cold Storage sealed in 1908, according to Acts of 1908, Chapter 441, and Acts of 1906, Chapter 201.

Quail,	49	packages; 254 dozen.
Teal,	11	packages; 312 birds.
Black ducks,	41	packages; 469 pairs.
Total,	101	

Many abuses of the laws relative to the sale of game have existed since the passage of the law forbidding the sale of

partridge, woodcock and quail killed in this Commonwealth. Until such time as the best sentiment of the sportsmen and of the general public is developed to a point where such a state of affairs is impossible, these evasions will probably exist in spite of the best efforts towards the enforcement of the law. Numberless cases are known where wealthy men directly or indirectly hire persons to shoot game birds to furnish "crumbs for the rich man's table." Similarly, birds are placed in storage where in many cases change of ownership is concealed in various ways. There is, however, a decided tendency among the best type of citizens to discountenance this condition of affairs, as is noted from the following letter, the names in which, for obvious reasons, are omitted: —

Oct. 11, 1908.

Dr. George W. Field.

My Dear Sir: — Last year two of the best shots in L—— left their regular work and hunted every day, a rich man paying them so much per week, they to turn over to him whatever number of birds they secured. Some of the business men and leading sportsmen came to me to see what could be done. Am pleased to report that this season neither will shoot for wages, — one not at all, and the other only one day a week, just for recreation. Many different influences have been brought to bear to bring about this result.

(Signed) ——— ———

The first year's experience with the law compelling the display of game by the person suspected of hunting illegally has been extremely satisfactory. We know of no case where the deputy has abused the confidence placed in him by the General Court, and we can point to many cases where gross violations of the law would otherwise have remained undetected. But most important has been the restraining influence upon would-be violators of a knowledge that they might at any time be called upon to exhibit the fish or game in possession.

The laws relative to requirements of hunters' licenses or registration for every person who hunts (with the sole exception of the farmer hunting upon land used exclusively for agricultural purposes) have fully met expectations, and have resulted not only in more efficient enforcement of the law,

but also have made it possible for a land owner to identify with certainty a person who either is doing or under certain circumstances might do damage to property.

Under the Acts of 1905, chapter 311, requiring unnaturalized foreign-born persons to procure from the town or city clerk a license to hunt, the following licenses were issued by sundry town and city clerks: —

1905 (2 licenses),	$30 00
1906 (9 licenses),	135 00
1907 (70 licenses),	1,053 00
1908 (40 licenses),	600 20
	$1,818 20

Under the Acts of 1907, chapter 198, this commission which issues hunting licenses to non-residents, has granted licenses as follows: —

1907, 81 licenses at $10,	$810 00
18 licenses at $1,	18 00
1908, 46 licenses at $10,	460 00
21 licenses at $1,	21 00
	$1,309 00

These amounts will be multiplied several fold by the returns from the hunting licenses for residents, according to Acts of 1908, chapter 484, which becomes operative Jan. 1, 1909. These licenses are issued by the clerk of the town or city, and the moneys are transmitted directly to the State Treasurer.

A systematic search for feathers of protected birds used for millinery purposes is being carried on among the stocks of the wholesale and retail dealers in the State. Information is freely given relative to methods of recognizing the forbidden feathers, even when disguised by dyes, cutting, etc. In cases of persistent violation the offenders are summoned to court. During the past year there has been a further development relative to the law prohibiting the possession of feathers of such protected birds for millinery purposes. During the past three

years warnings of various types have been extended to milliners and others relative to the law. During the past year 54 milliners and others have been called to court and fined for having such feathers in possession for millinery purposes. We believe that this is a most beneficial law, and that with the development of public sentiment and the wider knowledge of the deplorable destruction of birds which exists, a still larger number of States will place similar laws on their statute books.

The laws relative to the use of lobsters under 9 inches is well nigh a dead letter, on account of the practical impossibility of enforcing it with the means available.

Summary and Comparison of Deer Statistics, 1907 and 1908.

	1907.	1908.
Deer seen,	1,298	2,035
Deer chased by dogs,	114	120
Deer that have injured crops,	85	100
Deer shot illegally,	40	36
Deer killed by trains and trolley cars,	25	60
Deer shot while in the act of damaging crops,	16	17
Dead from other causes,	47	83
Notices issued relative to dogs chasing deer,	27	37
Court cases: —		
Dogs chasing deer,	5	2
Killing, hunting or wounding deer,	6	15
Live deer,	1,497	2,255
Dead deer,	128	196
Total number of deer (alive and dead),	1,625	2,451

Money paid by the State Treasurer, according to Acts of 1903, chapter 407, for damage done by wild deer: —

1903,	$237 30
1904,	392 25
1905,	1,117 05
1906,	2,822 73
1907,	2,912 78
1908,	4,370 03

Itemized List of Moneys received by the Commissioners on Fisheries and Game during the Year 1908 and paid to the Treasurer and Receiver-General.

Received for —	Amount.
Issuance of non-resident hunters' licenses, chapter 198, Acts of 1907,	$492 30
Heath-hen fund, chapter 504, Acts of 1907,	1,332 00
Sale of egg-bearing lobsters to United States Bureau of Fisheries Stations,	840 63
Sale of deer carcasses by town clerks, chapter 377, Acts of 1908,	36 05
Forfeitures (nets, etc.),	16 02
Forfeitures (pike perch),	30 00
	$2,747 00

Inspection of Fish. — There have been no requests for the inspection of fish, under chapter 138, Acts of 1902, and no fees have been received.

Recommendations for Legislation.

The Commissioners on Fisheries and Game respectfully recommend the passage of laws designed to accomplish the following purposes: —

1. That investigation be made of the infectious diseases of native birds, and of foreign birds introduced into the State, with a report including expert opinions upon the probability of such diseases spreading among our native birds, and, so far as possible, suggesting remedies and methods for preventing such infection, and that for these purposes money be appropriated from money received by the Commonwealth for hunting licenses.

2. That a biological investigation and report be made upon the adaptability of the public waters of the State for rearing food fishes, to devise methods and to determine as nearly as possible the quantity of fish which various waters are capable of producing annually, to ascertain the best methods of stocking such waters, and that an appropriation not exceeding $2,000 a year for three years be appropriated for this purpose.

3. That paid deputies of this commission should be given power to arrest hunters when in the act of damaging property or of trespassing, or upon complaint of a land owner.

4. That the laws relative to shooting from boats propelled by mechanical means other than oars should be so defined as to make plain their meaning relative to power boats when not under power.

5. For the protection of birds on their northern migration, and to secure an increase in the birds of various species which formerly nested in large numbers in this State, no shooting should be permitted after January first.

6. The killdeer and the piping plovers should be protected at all times, on account of the imminence of extinction.

7. Suitable provision should be made to grant non-residents the right to hunt foxes in this State without the necessity of a ten-dollar license.

8. That the commission should have authority to purchase, lease or receive as gift lands to be used as bird reservations, *i.e.,* specially protected breeding places for birds. Property thus acquired should become the property of the Commonwealth, to be administered by the Commissioners on Fisheries and Game for the purpose of securing the utmost possible population of useful birds. Whenever necessary to confirm titles, power of eminent domain should be given similar to that in chapter 504, Acts of 1907, and that of the money received by the Commonwealth for hunters' licenses a sum not exceeding $5,000 annually may be expended for the purpose of acquiring land.

9. That to secure more satisfactory enforcement of the laws the legal measurement of lobsters should be made upon the shell (carapace), exclusive of the tail, and that this legal measure of length should be 4¾ inches, in conformity with the law of Maine.

10. That all lobster fishermen, dealers, smack captains and all persons catching or transporting lobsters within this Commonwealth should be licensed, and that persons convicted of violation of the State law should be prohibited from fishing for one year from date of conviction.

11. We renew our recommendations of last year for more adequate and economical facilities for propagating and distributing food fish and useful birds.

12. Also for such amendment of the laws as to ensure the development of the mollusk fisheries below high-water mark in such a manner as to permit increase in the economic yield of food material; to furnish wider opportunities for remunerative employment of skilled and unskilled labor; to increase the taxable property of the shore towns and cities; and to bring revenue to the Commonwealth.

13. The following resolutions were passed at a conference of the State commissioners on fisheries of New England, held in Boston Dec. 8, 1908, and we urgently recommend these to your attention: —

Resolved, (1) That it is the opinion of this conference that the land below high water should be made more available for cultivation of mollusks.

(2) That such areas should be leased for the purpose of securing individual opportunities for cultivation.

(3) That such leases should be controlled by the State in order to secure the maximum amount of protection to the lease holders, permanency of policy, freedom from petty politics and greater responsibility in administration.

Resolution of the committee: —

Whereas, In all New England States there exist conditions whereby the public waters are becoming annually more polluted by the introduction of sewage, manufactory wastes, etc., resulting in a distinct menace to the public health and seriously impairing the productive capacity of the water and of the land under the water; and

Whereas, With increasing population these waters and submarine areas are becoming more necessary for the production of human food, both of fish and shellfish, both for local consumption and for sale in distant markets; and

Whereas, A private individual or corporation is not permitted by law to run sewage, manufactory waste, etc., upon the land of his neighbor, similarly it should not be permitted to run these materials into public waters or upon public land; therefore, be it

Resolved, That it is the carefully considered opinion of this conference of delegates, meeting in Boston in this the first an-

nual conference called by the Governors of the New England States, that the unnecessary pollution of the public streams and coastal waters should be immediately and decisively checked by suitable action of the respective legislatures. *Voted.*

14. That the laws be amended so as to permit the purchase, sale and possession at any time of rabbits or hares, which have not been taken or killed contrary to the laws of this Commonwealth or of any other State or country.

15. Inasmuch as those mechanical devices known as "silencers," which have been adapted for firearms, can be used to make the enforcement of the game laws still more difficult than at present, we suggest that the question of the prohibition of the use, sale or possession of such devices may be properly considered, and the necessary action taken.

16. Amendment of chapter 401, Acts of 1855, for the purpose of securing free passage of migratory fish, both up and down Taunton Great River and Nemasket.

17. Artificially reared trout should be sold at any season of the year, provided the proper safeguards exist for distinguishing wild from artificially reared trout.

Courtesies.

It is a pleasure again to acknowledge the assistance so courteously rendered to the commission by Mr. Arthur L. Millett, local agent of the United States Bureau of Fisheries at Gloucester, and by Mr. F. F. Dimick, the efficient secretary of the Boston Fish Bureau.

Permits to hold in confinement egg-bearing lobsters for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 499 fishermen and dealers.

Permits for taking birds and eggs under section 9, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following-named persons: —

Chester S. Day, West Roxbury.
B. G. Willard, Millis.
Nathan F. Stone, Worcester.
F. B. McKechnie, Boston.
F. H. Carpenter, Seekonk.
John H. Hardy, Jr., Boston.
Clarence Birdseye, Amherst.
Chester A. Reed, Worcester.
A. H. Tuttle, Cambridge.
A. C. Bent, Taunton.
J. A. Barton, Fitchburg.
Owen Durfee, Fall River.
Frederick H. Kennard, Boston.
Arthur F. Gilbert, New Bedford.
Frank S. Akin, Fall River.
William H. Dearden, Springfield.
Haynes H. Chilson, Northampton.
F. H. Scott, Westfield.
Robert O. Morris, Springfield.
George M. Gray, Woods Hole.
W. W. Judd, North Adams.

Permit to take gulls and terns for scientific purposes was issued to: —

Clarence L. Hauthaway, Cambridge.

Permit to have in possession for purposes of propagation live quail was issued to: —

Clarence M. Snow, Provincetown.

Permit to have in possession for purposes of propagation ruffed grouse and quail was issued to: —

C. F. Hodge, Worcester.

Permit to have in possession native insectivorous birds, to be used in connection with experiments and observations upon the use of birds for destroying certain flies, in greenhouses, was issued to: —

Seth A. Borden, Fall River.

Permits to have in possession for purposes of propagation wild ducks were issued to: —

Seth A. Borden, Fall River.
Charles D. Hunt, Fall River.

Permits to shoot pheasants under chapter 477, Acts of 1908, were issued to: —

Bayard Thayer, Lancaster.
Laurence Minot, Wareham.
Stephen M. Weld, Boston.

Permits to have in possession ducks of any species, anywhere in Massachusetts, at any season, were issued to: —

William P. Wharton, Groton.
Guilford C. Hathaway, Fall River.
Benjamin Brown, Fall River.

Permit to have black ducks in possession for purposes of propagation was issued to: —

R. E. Warren, Boston.

Permit to have in possession pheasant, woodcock and partridge, for scientific purposes, was issued to: —

John H. Hardy, Jr., Boston.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to the following persons: —

Elmer A. Durgin, Rowley.
Walter N. Johnson, Rowley.
Alfred Richardson, Rowley.
A. P. Hilton, Newburyport.
Maynard Eaton, Newburyport.
James Crooks, Newburyport.
George L. Whittemore, Newburyport.
G. E. Pettingill, Newburyport.
H. G. W. Graf, Newburyport.
Fred McBurney, Newburyport.
Henry Godfrey, Newburyport.
Richard E. Pierce, Newburyport.

Permit to have in possession at any season of the year, for purposes of propagation, black bass, trout and pickerel, also to use minnow traps and casting nets, was issued to: —

W. Endicott Dexter, Boston.

Permit to take smelts from any stream, during the close season, for the purpose of ascertaining facts regarding breeding habits, was issued to: —

William W. Nixon, Somerville.

Permits to take lamprey eels for scientific purposes were issued to: —

William N. Holmes, Lawrence.
George M. Gray, Woods Hole.

Permit to transfer spawning white perch and pickerel to a satisfactory spawning ground was issued to: —

Charles E. Tribou, Brockton.

Permit to transfer spawning white perch to a satisfactory spawning ground was issued to: —

Havier L. Gonzales, Lowell.

Permit to have in possession for scientific purposes lobsters of any size was issued to: —

Marine Biological Laboratory, Woods Hole.

Permit to use a seine in ponds of the Commonwealth for taking fish for scientific purposes was issued to: —

Thomas L. Burney, West Lynn.

Permit to catch trout in fly-casting tournament was issued to: —

New England Forest, Fish and Game Association, Boston.

Permission has been given in eleven instances during the past year to M. Abbott Frazar Company of Boston to mount birds protected by law, which have been killed accidentally.

Respectfully submitted,

GEORGE W. FIELD.
JOHN W. DELANO.
GEORGE H. GARFIELD.

APPENDICES.

[A.]

List of Commissioners.

United States Bureau of Fisheries, Washington, D. C.

George M. Bowers, Commissioner.
Hugh M. Smith, Deputy Commissioner.
Irving H. Dunlap, Chief Clerk.
John W. Titcomb, Assistant in charge of Division of Fish Culture.
Barton W. Everman, Assistant in charge of Division of Inquiry Respecting Food Fishes.
A. B. Alexander, Assistant in charge of Division of Statistics and Methods.
Hector Von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.
Charles G. Atkins, Craig Brook, East Orland, Me.
E. E. Hahn, Boothbay Harbor, Me.
W. F. Hubbard, Nashua, N. H.
E. N. Carter, St. Johnsbury, Vt.
C. G. Corliss, Gloucester, Mass.
E. F. Locke, Woods Hole, Mass.
Chester K. Green, Cape Vincent, N. Y.
L. G. Harron, Washington, D. C.
George A. Seagle, Wytheville, Va.
R. K. Robinson, White Sulpher Springs, W. Va.
H. D. Aller, Beaufort, N. C.
J. J. Stranahan, Cold Springs, Bullochville, Ga.
C. W. Burnham, Tupelo, Miss.
S. G. Worth, Edenton, N. C.
A. G. Keesecker, Fishery, Tenn.
S. W. Downing, Put-in-Bay, O.
Frank N. Clark, Northville, Mich.
S. P. Wires, Duluth, Minn.
S. P. Bartlett, Quincy, Ill.
R. S. Johnson, Manchester, Ia.
H. D. Dean, Neosho, Mo.
J. L. Leary, San Marcos, Tex.
W. T. Thompson, Leadville, Col.

D. C. Booth, Spearfish, S. D.
James A. Henshall, Bozeman, Mont.
G. H. Lambson, Baird, Cal.
Henry O'Malley, Clackamas, Ore.
A. H. Dinsmore, Baker Lake, Wash.
W. K. Hancock, Yes Lake, Alaska.
M. F. Stapleton, Mammoth Spring, Ark.
C. P. Henkle, Afognak, Alaska.

Alabama.

Game and Fish Commissioner.

John H. Wallace, Jr., ... Montgomery.

Arizona.

Fish and Game.

T. S. Bunch, ... Safford.
W. L. Pinney, Secretary, ... Phœnix.
E. A. Sliker, ... Flagstaff.

California.

George Stone, President, ... San Francisco.
F. W. VanSicklen, ... Alameda.
M. J. Connell, ... Los Angeles.
Charles A. Vogelsang, Chief Deputy, . . . San Francisco.

Colorado.

David E. Farr, Commissioner, ... Denver.
R. L. Spargur, Chief Clerk, ... Denver.
W. S. Kincaide, Superintendent of Hatcheries, . Denver.
C. W. Lake, Deputy Commissioner, . . . Denver.

Connecticut.

George T. Mathewson, President, . . . Thompsonville.
E. Hart Geer, Secretary, ... Hadlyme.
John M. Crampton, ... New Haven.

Delaware.

Game Protective Association.

A. D. Poole, President, ... Wilmington.
E. G. Bradford, Jr., Secretary and Treasurer, . Wilmington.

Florida.

Honorary Fish Commissioner.

John Y. Detwiler, ... New Smyrna.

Georgia.

Fish Commissioner.

A. T. Dallis, ... LaGrange.

Idaho.

Fish and Game Warden.

William N. Stephens, ... Boisé.
B. T. Livingston, ... Boisé.

Illinois.

State Game Commissioner.

John A. Wheeler, ... Springfield.

Board of Fish Commissioners.

Nat H. Cohen, President, ... Urbana.
S. P. Bartlett, Superintendent and Secretary, . Quincy.
Henry Kleine, ... Chicago.

Indiana.

Z. T. Sweeney, Commissioner, ... Columbus.
E. E. Earle, Chief Deputy, ... Indianapolis.

Iowa.

Fish and Game Warden.

George A. Lincoln, ... Cedar Rapids.

Kansas.

D. W. Travis, ... Pratt.

Maine.

Inland Fisheries and Game.

L. T. Carleton, Chairman, ... Winthrop.
J. W. Brackett, ... Phillips.
Edgar E. Ring, ... Orono.

Sea and Shore Fisheries.

James Donahue, Commissioner, . . . Rockland.

Maryland.

Fisheries Commissioners.

Samuel J. Twilley, ... Worcester County.
Charles F. Brooke, ... Montgomery County.

Game Warden.

H. F. Harmonson, ... Berlin.

MASSACHUSETTS.

Commissioners on Fisheries and Game.

George W. Field, Chairman, ... Boston.
John W. Delano, ... Marion.
George H. Garfield, ... Brockton.

MICHIGAN.

Fish Commissioners.

Charles D. Joselyn, President, ... Detroit.
George M. Brown, Vice-President, . . . Saginaw.
Delbert H. Power, ... Suttons Bay.

Game, Fish and Forestry Warden.

Charles S. Pierce, ... Lansing,

MINNESOTA.

Game and Fish Commissioners.

O. J. Johnson, President, ... Glenwood.
John H. Grill, First Vice-President, . . . Sherburn.
Joseph Vessel, Second Vice-President, . . Crookston.
Robert Hannah, Secretary, ... Fergus Falls.
Carlos Avery, Executive Agent,. . . . Hutchinson.
S. F. Fullerton, Superintendent of Hatcheries, . St. Paul.

MISSOURI.

Fish Commissioners.

Richard Porter, ... Paris.
John M. Shortal, ... St. Louis.
W. H. Hughes, ... St. Louis.
William Babb,. . . . . . . St. Joseph.
John Gates, ... Browning.

State Game and Fish Warden.

J. C. Bassford,. . . . . . . Mexico.

MONTANA.

State Game and Fish Warden.

Henry Avare, ... Helena.

NEBRASKA.

Gov. A. C. Shellanberger, Commissioner ex-officio,	Lincoln.
Dan Geilus, Chief Deputy, ...	Lincoln.
W. J. O'Brien, Superintendent of Hatcheries, .	Gretna.

NEVADA.

Fish Commission.

George T. Mills, ...	Carson City.
E. B. Yerington, ...	Carson City.
H. H. Coryell, ...	Carson City.

NEW HAMPSHIRE.

Nathaniel Wentworth, Chairman, . . .	Hudson Centre.
Charles B. Clarke, ...	Concord.
Frank P. Brown, ...	Whitefield.

NEW JERSEY.

B. C. Kuser, President, ...	Trenton.
William A. Logue, Treasurer, ...	Bridgeton.
Percival Christie, ...	High Bridge.
Simeon H. Rollinson, ...	West Orange.

NEW MEXICO.

Game and Fish Warden.

W. E. Griffin, ...	Santa Fé.

NEW YORK.

Forest, Fish and Game Commission.

James S. Whipple, Commissioner, . . .	Salamanca.
J. Duncan Lawrence, Deputy, ...	Bloomville.
John D. Whish, Secretary, ...	Albany.

State Superintendent of Marine Fisheries.

B. Frank Wood, ...	New York.

NORTH DAKOTA.

District Game Warden.

W. N. Smith, District No. 1, ...	Grafton.
Olaf Bjorke, District No. 2, ...	Abercrombie.

Ohio.

Commissioners of Fish and Game.

Paul North, President,	Cleveland.
Thomas B. Paxton,	Cincinnati.
J. F. Rankin,	South Charleston.
D. W. Greene,	Dayton.
George W. McCook,	Steubenville.
George C. Blankner, Secretary,	Columbus.
J. C. Speaks, Chief Warden,	Columbus.

Oklahoma.

Game and Fish Warden.

Eugene Watrous,	Enid.

Oregon.

Master Fish Warden.

H. C. McAllister,	Portland.

Game Warden.

R. O. Stevenson,	Forest Grove.

Pennsylvania.

Game Commissioners.

James H. Worden, President,	Harrisburg.
C. K. Sober,	Lewisburg.
William H. Myers,	Williamsport.
Charles B. Penrose,	Philadelphia.
John M. Phillips,	Pittsburg.
Arthur Chapman,	Doylestown.
Dr. Joseph Kalbfus, Secretary,	Harrisburg.

Department of Fisheries.

W. E. Meehan, Commissioner,	Harrisburg.

Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phœnixville.
W. A. Leisenring,	Mauch Chunk.

Rhode Island.

Commissioners of Inland Fisheries.

Henry T. Root, President,	Providence.
William P. Morton, Secretary,	Providence.
J. M. K. Southwick,	Newport.

Charles W. Willard,	Westerly.
Adelbert D. Roberts,	Woonsocket.
Albert Davis Mead,	Providence.
William H. Boardman,	Central Falls.

Commissioners of Shellfisheries.

James M. Wright,	South Scituate.
Herbert M. Gardiner,	Barrington.
Philip H. Wilbour,	Little Compton.
George W. Hoxie,	Charlestown.
James H. Northup,	Warwick.
James C. Collins, Clerk,	North Providence.

Commissioners of Birds.

C. H. Remington, Chairman,	East Providence.
W. Gordon Reed, 2d,	Cowesset.
E. R. Lewis,	Westerly.
William H. Thayer,	Bristol.
A. O'D. Taylor,	Newport.

Tennessee.

State Warden.

Joseph H. Acklen,	Nashville.

Texas.

Game, Fish and Oyster Commission.

R. H. Wood,	Rockport.

Utah.

H. B. Cromar,	Salt Lake City.

Vermont.

H. G. Thomas,	Stowe.

Virginia.

Board of Fisheries.

W. McDonald Lee, Chairman,	Irvington.
S. Wilkins Matthews, Secretary,	Oak Hall.
George B. Keezell,	Keezletown.
Bland Massie,	Tyro.
J. Murray Hooker,	Stuart.

Washington.

Fish Commissioner and Game Warden Ex Officio.

John L. Riseland,	Bellingham.

West Virginia.

Game and Fish Warden.

James H. Marcum, ... Huntington.

Special Deputy.

F. H. Merrick, ... Huntington.

Wisconsin.

State Warden.

J. W. Stone, ... Barron.

Commissioners of Fisheries.

The Governor, ex officio.
Calvert Spensley, President, ... Mineral Point.
James J. Hogan, Vice-President, ... LaCrosse.
E. A. Birge, Secretary, ... Madison.
William J. Starr, ... Eau Claire.
Henry D. Smith, ... Appleton.
Jabe Alford, ... Madison.
A. A. Dye, ... Madison.
James Nevin, Superintendent, ... Madison.

Wyoming.

State Game Warden.

D. C. Nowlin, ... Lander.

[B.]

Distribution of Food Fish.

Trout Fry.

Distribution of Fry from the Adams Hatchery during April and May, 1908.

Applicant.	Town.	Name of Brook.	Number.
Edward J. Spall,	Pittsfield,	Duncan,	5,000
Luke J. Minahan,	Lanesborough,	Holly,	5,000
William H. Newton,	Lanesborough,	Daniels,	5,000
John W. Downes,	Pittsfield,	Merrill and Milton,	5,000
William P. McMann,	Lanesborough,	Rice,	5,000
Dr. Thomas F. Curtin,	Lanesborough,	Wells,	5,000
A. A. Dooley,	Pittsfield,	Milton,	5,000
George S. Baker,	Pittsfield,	Jacoby,	5,000
C. A. Acly,	Pittsfield,	Sackett,	5,000
James M. Burns,	Pittsfield,	Shaker,	5,000
Walter G. Wood,	Chester,	Day,	5,000
W. E. Smith,	North Chester,	Westfield River,	5,000
William H. Fowler,	Chester,	Kinney,	5,000
George A. Smith,	Chester,	Ward Lot,	5,000
Frank E. Cone,	Chester,	Packard,	5,000
H. E. Day,	Chester,	Day,	5,000
Allie R. Fisk,	Chester,	Westfield River,	5,000
E. F. Goodwin,	Chester,	Winchell,	5,000
George F. Sayles,	Adams,	Hoosac River,	10,000
George F. Sayles,	Adams,	Fisk,	
John R. Parker,	Savoy,	Westfield River,	5,000
L. E. Flanders,	Savoy,	Gulf,	5,000
W. S. Hathaway,	Savoy,	Horton,	5,000
Harry J. Sheldon,	Cheshire,	Kitchen,	5,000
John W. Downes,	Pittsfield,	Merrill and Milton,	10,000
John McCormick,	Windsor,	McCormick,	5,000
W. H. Spear,	West Stockbridge,	Stickles,	5,000
C. A. Acly,	Lenox,	Yokum,	5,000
Benjamin T. Henry,	Rowe,	Shippee,	5,000
Sanborn G. Tenney,	Williamstown,	Sweet,	10,000
James H. Krum, Jr.,	North Adams,	North Branch,	
James H. Krum, Jr.,	North Adams,	Tunnel,	15,000
James H. Krum, Jr.,	North Adams,	Hudson,	
James M. Van Huyck,	Lee,	Landers,	10,000
			185,000

Fry distributed from the Hadley Hatchery during April and May, 1908.

Chester A. Hinds,	Orange,	Swift River (west),	5,000
W. H. Gale,	Orange,	Cheney,	
J. N. Moore,	Orange,	Goodell,	10,000
A. M. Lyman,	Montague,	Shingle Swamp,	5,000
Fannie E. Hawks,	Goshen,	Packard,	5,000
John Doherty,	Goshen,	Hampshire,	5,000
W. A. Smith,	Goshen,	Highland,	5,000
M. W. Smith,	Goshen,	Rogers,	5,000
J. R. Beaudoin,	Chicopee Falls,	Cooley,	5,000
William H. Robert,	Chicopee Falls,	Poor,	5,000
Francis H. Graves,	– – –	– – – –	5,000
Joseph R. Parker,	Chicopee,	Cooley,	5,000
H. F. Moulton,	Hardwick,	Newton,	5,000
H. N. Fisherdick,	Hardwick and Ware,	Muddy,	5,000
Dennis F. Shea,	Ware,	Flat,	5,000

Fry distributed from the Hadley Hatchery, etc. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
George Allard,	Ware,	Leonard,	5,000
George E. Smith,	Greenwich,	Manly,	5,000
Fred E. Field,	Montague,	Cold,	5,000
John W. Haigis,	– – –	– – – –	5,000
Frank E. Briggs,	Montague,	Saw Mill River,	5,000
W. G. Bisbee,	Williamsburg,	West Branch,	5,000
Fred LaValley,	Williamsburg,	East Stream,	5,000
A. J. Polmatin,	Williamsburg,	Goshen,	5,000
W. G. Bisbee,	Williamsburg,	West Branch,	5,000
C. M. Drake,	Chesterfield,	Page,	
C. M. Drake,	Chesterfield,	Porter,	15,000
C. M. Drake,	Chesterfield,	Munson,	
A. W. Hanson,	Erving,	Jack,	5,000
Fred P. Titcomb,	Northampton,	Parsons,	5,000
Duane Edwards,	Northampton,	Roberts Meadow,	5,000
Frank W. Roberts,	Northampton,	Running Gutter,	5,000
William G. Nicholl,	Northampton,	Broad,	5,000
Sumner L. Munson,	Whately,	West,	5,000
George R. Turner,	Williamsburg,	Grass Hill,	5,000
			170,000

Fry distributed from the Sutton Hatchery during April and May, 1908.

O. O. Oliver,			
John M. Sauter,			
Leon H. Bowers,			
C. F. Bowers,			
Edward G. Clark,	Westfield,	Munn's,	60,000
Alfred Read,		Powder Mill,	
R. K. Andrews,			
L. C. Coburn,			
Harry Smith,			
W. G. Bailey,			
J. A. Barton,	Townsend,	Lord,	30,000
J. A. Barton,	Fitchburg,	Ashburnham,	
Henry E. Dean,	– – –	– – – –	5,000
Henry E. Dean,	– – –	– – – –	5,000
Norton Company,	Worcester,	Barber's,	5,000
Gardner M. Dean,	Oakham,	Five Mile,	5,000
Myron R. Goddard,	Hubbardston,	Otter River,	5,000
D. H. Gates,	Gardner,	Perley,	5,000
L. G. McKnight,	Gardner,	Crow Hill,	5,000
F. W. Dinwiddie,	Gardner,	Perley,	5,000
F. A. Gravlin,	Gardner,	Bailey,	5,000
A. W. Pratt,	Gardner,	Bailey,	5,000
Oliver K. Pierce,	Ayer,	Black Pond,	5,000
Joseph P. Love,	Dudley,	Potash,	5,000
Charles B. Adams,	Webster,	Potash,	5,000
W. F. Durgin,	Mendon,	Valley,	5,000
Windsor F. Neal,	Westminster,	Moore,	5,000
Arthur G. Chickering,	Lancaster,	Pine Hill,	5,000
Michael J. Shea,	Warren,	South Street,	5,000
John F. Hayden,	Palmer,	Swift River,	5,000
Charles S. Ballard,	Hampden,	Scantic River,	5,000
H. G. Howard,	– – –	– – – –	5,000
Henry H. Hallock,	Hubbardston,	Joe Pond,	5,000
George L. Gill,	Northbridge,	Northbridge,	10,000
W. L. Taft,	Northbridge,	Brigham,	
M. H. Coffin,	Northbridge,	– – – –	10,000
C. V. Dudley,	Northbridge,	Prentice,	
Elmer A. Macker,	North Grafton,	Carroll's,	10,000
Elmer A. Macker,	North Grafton,	Bummit,	
Henry W. Carter,	Millbury,	No Name,	5,000
Joseph E. Werme,	– – –	– – – –	5,000
T. B. Stevenson,	– – –	– – – –	5,000
Henry Courtemanche,	Southbridge,	Keenan,	5,000
A. D. Norcross,	– – –	– – – –	10,000
Charles E. Bass,	Orange,	Cheney Mansion,	5,000
Oliver K. Pierce,	Littleton,	Black Pond,	5,000
A. I. Hunting,	– – –	– – – –	5,000
			270,000

Fry distributed from the Winchester Hatchery during April and May, 1908.

Applicant.	Town.	Name of Brook.	Number.
Percy E. Varnum,	Tyngsborough,	Flint's,	4,000
Harry K. Noyes,	– – –	– – – –	4,000
F. W. Vaughn,	Lowell,	Cowdry,	4,000
S. J. Bigelow,	North Chelmsford,	Swain's,	4,000
William E. Badger,	– – –	– – – –	4,000
George W. Alcott,	Chelmsford,	Black,	4,000
Willis S. Holt,	Andover,	Hardy's,	4,000
H. E. Richardson,	Westford,	Keyes,	4,000
Caleb L. Smith,	Chelmsford Center,	Blind,	4,000
F. A. Griffin,	Westford,	Nashoba,	4,000
Herbert E. Lord,	Burlington,	Winn Street,	4,000
Dr. E. R. Chalmers,	Woburn,	Cummings,	4,000
M. E. Sibley,	Saugus,	Mansfield's,	4,000
M. F. Holt,	Wilmington,	Chemical,	4,000
Arthur E. Roberts,	Reading,	Northwest and Burton,	4,000
South Acton Fish and Game Association,	Acton,	Rocky,	4,000
		Taylor's,	4,000
Waltham Fish and Game Association,	Waverly and Waltham,	Beaver,	8,000
John J. Kennedy,	Stoughton,	Dead Meadow,	4,000
Thomas S. Prouty,	Sharon,	Spring,	4,000
N. F. M. Wilson,	East Foxborough,	Tecuanticut,	4,000
Richard L. Everit,	Wellesley,	Cold Spring,	4,000
Richard Olney, 2d,	Dedham,	– – – –	4,000
George B. Treen,	Mansfield,	Wilbur,	4,000
Edgar L. Freeman,	Medway,	Nealous,	4,000
Edgar L. Freeman,	Medway,	Turnpike,	4,000
Clyde C. Hunt,	Medway,	Cress,	4,000
Brockton Fish and Game Protection Association,	Brockton,	Beaver, Montello, Torrey,	12,000
Charles S. Baker,	Falmouth,	Coonamessett,	4,000
John W. Delano,	Rochester,	Doggett's,	4,000
Philip Rogler,	New Bedford,	Bread and Cheese,	4,000
C. E. Taylor,	Woburn,	Cummings,	4,000
C. C. Taylor,	Woburn,	Blanchard,	4,000
E. H. Ives,	Woburn,	Coleman,	4,000
D. F. McIntosh,	Woburn,	Cutter,	4,000
Wallace Penney,	Woburn,	Wood,	4,000
R. H. Magee,	Woburn,	Johnson,	4,000
Leominster,	Leominster,	Lunenburg,	20,000
Sportsmen's Association,	Lunenburg,	Houghton,	
George H. White,	Randolph,	Cold Spring,	4,000
			184,000

Fingerling Trout Plants during Fall of 1908.

Joseph P. Love,	Webster,	Potash,	250
Charles B. Adams,	Webster,	Sucker,	250
Henry W. Carter,	Millbury,	Sutton,	500
F. A. Anderson,	Grafton,	Quinsigamond,	250
Elmer A. Macker,	North Grafton,	Carroll's and Bummit,	500
W. R. Wallis,	Douglas,	Howell,	250
W. L. Church,	South Douglas,	Parker,	250
T. B. Stevenson,	– – –	– – – –	250
John H. Stockman,	Charlton,	Aldrich, Davidson, McKinstry,	750
A. D. Norcross,	Charlton,	Barnum,	250
B. J. Bertels,	Worcester,	South,	250
Henry E. Dean,	Worcester,	Lincoln and Beaver,	750
Norton Company,	Worcester,	Barber's,	250
Peter Baker,	Worcester,	Poor Farm,	250
Jay Snell,	Quinapoxet,	Ball,	250
H. S. Tripp,	Spencer,	Thompson,	250
H. H. Capen,	Spencer,	Howes,	500
A. P. Morin,	North Brookfield,	Bigelow, Mad, Town Farm,	1,000
Michael J. Shea,	Warren,	South Street,	250
William Wadsworth,	Holden,	Holden,	250
Hiram J. Parent,	Holden,	Fessenden,	250
Thomas H. Davis,	Holden,	Parsons,	250
W. L. Taft,	Northbridge,	Poor Farm,	250
George L. Gill,	Northbridge,	Northbridge,	250
M. H. Coffin,	Northbridge,	Devlin,	250

Fingerling Trout Plants during Fall of 1908 — Continued.

Applicant.	Town.	Name of Brook.	Number.
C. V. Dudley,	Northbridge,	Prentice,	250
J. F. Cummings,	Shrewsbury,	Rawson Hill,	250
George P. King,	Paxton,	Carruth,	250
J. S. Hubbard,	Sturbridge,	Long Pond,	250
P. S. Callahan,	Sturbridge,	Clay,	250
John Day, Jr.,	Sturbridge,	Bemis,	250
John L. Houde,	Sturbridge,	Hinman,	250
E. F. Dakin,	Southbridge,	McKinstry,	250
Frank Brissette,	Southbridge,	Side Hill Stream,	250
Abel E. Whitaker,	Southbridge,	McKinstry,	250
F. S. Stockwell,	Auburn,	Stone's,	250
Rufus E. Howe,	Sterling,	South Meadow,	500
James M. Burns,	Pittsfield,	Yokum and Sackett,	1,000
William H. Newton,	Pittsfield,	Daniels and Sachem,	1,000
A. L. Boudreau,	– – –	– – – –	500
George S. Baker,	– – –	– – – –	500
James R. Williams,	Douglas,	Howell,	250
George F. Sayles,	Adams,	Dry,	1,000
William P. Martin,	Adams,	Palton and Tophet,	1,000
Francis O'Neill, Jr.,	Adams,	Fisk and Tophet,	1,000
Lucian B. Moore,	Tyringham,	Hop,	500
Sanborn G. Tenney,	Williamstown,	Hemlock and Buxton,	1,000
John R. Parker,	Savoy,	Tributary Westfield River,	500
F. N. Haskins,	Savoy,	Haskins,	500
Michael Clancy,	Cheshire,	Kitchen,	500
Francis O'Neill,	Cheshire,	Collins,	500
Henry Hosburgh,	Dalton,	Cady,	1,000
George Blood,	State Line,	Stickle,	500
W. J. Ingram,	South Lee,	Powder Mill,	500
C. M. Jacot,	Stockbridge,	Muddy,	1,000
F E. Hopkins,	– – –	– – – –	500
Homer E. Foote,	Great Barrington,	Alford,	1,000
Fred W. Truesdell,	Great Barrington,	Williams River,	1,000
David Ives Mackie,	Great Barrington,	Green River,	1,000
H. E. Day,	Chester,	Westfield River,	500
Frederick A. Moulton,	Chester,	Walker,	1,000
G. E. Curry,	Chicopee Falls,	Cooley and Poor,	1,000
Francis H. Graves,	– – –	– – – –	1,000
Ira J. Humes,	Holyoke,	Broad,	1,000
A. D. Norcross,	Monson,	Conant and Gulf,	1,000
George J. Shumway,	Holyoke,	Broad,	1,000
D. T. Strange,	Stoneham,	Willow,	500
Charles E. Arnold,	Stoneham,	Aberjona,	500
L. A. Penney,	Wilmington,	Richardson Pond,	500
M. E. S. Clemons,	Wakefield,	Means, Saunders, Kittredge,	500
Waltham Fish and Game Protective Association,	Waltham,	Cherry and others,	2,500
Robert Chalmers,	South Billerica,	Greenwood and Meadow,	500
J. A. Whitcomb,	Ayer,	Shaker,	500
Harry G. Frost,	Hudson,	Parmenter,	500
Frank D. Cheney,	Dunstable,	Unkety,	500
D. J. Whelton,	South Peabody,	Norris,	500
S. H. Sinclair,	Middleton,	Poor's,	500
Geo. E. Patterson,	Hamilton,	Miles,	500
H. T. Drew,	South Lawrence,	Cold Spring,	1,000
M. E. Sibley,	North Saugus,	Howlit,	500
H. D. O'Brien,	Rowley,	Batchelder,	500
O. B. Tarbox,	Newbury,	Saw Mill and Courser,	1,000
Fitchburg Rifle and Gun Club,	Fitchburg,	Sheldon, Lock, Lord, Mulpus, Ashburnham,	2,500
Dr. E. F. Lincoln,	Leominster and Lunenburg,	Fort, Lunenburg, Monoosnuck,	2,500
Fred S. Casavant,	Gardner,	Poor Farm,	500
A. W. Pratt,	Gardner,	Bailey,	500
Walter Streeter,	– – –	– – – –	500
Myron R. Goddard,	Gardner,	Cook,	500
Henry E. Dean,	Oakham,	Pratt,	500
Henry L. Pierce,	Barre,	Prince River,	500
Arthur G. Chickering,	Lancaster,	Pine Hill,	500
W. F. Durgin,	Mendon,	Muddy,	500
Gardner M. Dean,	Oakham,	Nigger,	500
F. L. Hager,	Winchendon,	Carter and Beaman's,	500
H. G. Howard,	Ashburnham,	Cooper,	500
Henry H. Hallock,	Hubbardston,	Tan Yard,	500

Fingerling Trout Plants during Fall of 1908. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
J. W. Barney,	West Brimfield,	Quabog,	2,500
Alfred Read,	Westfield,	Munn's, Fowler, Powder Mill,	2,500
Charles S. Ballard,	Hampden,	Scantic,	500
Charles H. Sawyer,	Northampton,	Broad, Running Gutter, Roberts, Parsons,	2,500
George L. Harris,	Sunderland,	Welch,	500
W. S. Gabb,	Cummington,	Nipping,	1,000
L. W. Pettingill,	Cummington,	Mitchell,	1,000
D. F. Shea,	Ware,	Flat,	500
Lewis Albertine,	Ware,	Allard,	500
George E. Smith,	– – –	– – – –	500
J. W. Jackson,	Belchertown,	Pudding Mill,	500
A. S. Hunt,	New Salem,	West branch Swift River,	2,000
J. N. Moore,	Orange,	Jones,	2,000
Greenfield Sportsmen's Club,	Greenfield,	Kelly, Fisk and others,	2,500
F. E. Briggs,	Montague,	Sawmill,	1,000
A. M. Lyman,	Montague,	Wash House,	500
John W. Haigis,	Montague,	Pond,	500
C. L. Crafts,	Whately,	Glen,	500
Fred E. Field,	Montague,	Cold,	500
A. W. Hanson,	Erving,	Jacks,	500
W. P. Shumway,	Warwick,	Mosquito Mill,	500
Frank J. Knight,	Townsend,	Bixby and Barbery Mill,	500
Charles N. Hargraves,	South Framingham,	Rattlesnake and Angelica,	2,000
South Acton Fish and Game Protective Association,	South Acton,	Taylor,	2,500
James A. Baxter,	Reading,	Bear Meadow,	500
Charles A. Damon,	Reading,	West and North,	500
Rufus B. Dodge,	Charlton,	Migget,	850
Moses Gross,	Northborough,	Hows,	850
Joseph E. Werme,	Worcester and Auburn,	Hull,	850
H. H. Gabeler,	Northborough,	Hows,	850
M. C. Needham,	Coldbrook,	Coldbrook,	1,000
L. F. Earle,	Templeton,	Cook,	1,000
Frank A. Gravlin,	Hubbardston,	Lovell,	1,000
B. W. Buckley,	Ware,	Flat,	1,000
Michael J. Murray,	Holyoke,	Broad,	850
J. Frank Stone,	East Brookfield,	Walker Pond,	500
Frank F. Bullard,	East Brookfield,	Great,	500
Herbert C. Branch,	Webster,	Freeman,	1,000
N. Capen,	Spencer,	Meadow,	1,000
D. E. Halley,	Methuen,	Barker's,	1,000
Charles S. Baker,	Falmouth,	Coonamessett,	1,000
Brockton Fish and Game Protective Association,	Brockton,	Torrey, Montello, Beaver,	2,000
Frank H. Shaw,	Abington and South Weymouth,	Grove Pond, Old Swamp,	800
Charles W. Davol,	Freetown,	Rattlesnake,	1,200
G. F. Howard,	Berkley,	Wild,	800
H. H. Packard,	Attleborough,	Bungy,	1,000
Clyde C. Hunt,	Medway,	Lone Star and Black Fly,	1,200
Edgar L. Freeman,	Medway,	Dewey,	800
John Kennedy,	Stoughton,	Dead Meadow,	800
Richard Olney, 2d,	Dedham,	Meadow,	800
Walter F. Ellis,	– – –	– – – –	800
George E. Bessom,	Mansfield,	Meadow,	400
Carroll S. Cobb,	Mansfield,	Hersey,	400
Albert T. Hodges,	Mansfield,	Town Farm,	400
D. D. Spaulding,	Mansfield,	Hersey,	400
Philip Rogler,	New Bedford,	Bread and Cheese,	1,000
Joseph E. Grassie,	Norwell and Hingham,	Norwell and Long Lane,	800
			112,600

Ponds stocked and closed in Accordance with Chapter 91, Section 19, Revised Laws, as amended by Chapter 274, Acts of 1903, and further amended by Chapter 306, Acts of 1907.

Name of Pond.	Town.	Rainbow Trout.			Brown Trout.		
		Finger-lings.	Year-lings.	Adults.	Finger-lings.	Year-lings.	Adults.
Robin's,	East Bridgewater,	–	–	–	2,000	–	–
Lake Dennison,	Winchendon,	1,500	–	–	–	–	–
Boot,	Plymouth,	–	–	–	1,500	–	–
Eddy,	Auburn,	–	–	–	2,000	–	–
Crystal Lake,	Haverhill,	1,500	–	–	–	–	–
Nagog Lake,	Acton and Littleton,	–	175	12	–	150	12
		3,000	175	12	5,500	150	12

Ponds restocked during the Year 1908.

Name of Pond.	Town.	Brook Trout, Adults.	Rainbow Trout, Finger-lings.	Brown Trout, Finger-lings.	Land-locked Smelt Eggs.
Stiles,	Boxford,	–	–	1,500	–
Spectacle,	Littleton,	–	1,500	–	–
Forge,	Littleton,	–	–	2,000	–
Attitash Lake,	Amesbury,	–	–	1,500	5,000,000
Quinsigamond,	Shrewsbury,	–	–	2,000	–
Bucks,	Harwich,	–	–	–	2,000,000
Bridge Creek,	West Barnstable,	–	–	–	2,000,000
White,	Chatham,	–	–	–	2,000,000
Singleterry,	Millbury,	230	–	–	–
Quinsigamond River,	Grafton,	100	–	–	–
Quinsigamond Lake,	Worcester,	210	–	–	–
Chebogagog,	Webster,	400	–	–	–
		940	1,500	7,000	11,000,000

[C.]

Distribution of Pheasants.

Applicant.	Town.	Number.
Charles C. Church,	Millbury,	8
Willard H. Bates,	Millbury,	6
W. J. Stone,	Auburn,	6
Charles B. Adams,	Webster,	6
H. Courtemanche,	Southbridge,	6
Henry E. Dean, Gardner M. Dean,	Worcester,	6
F. E. Hopkins,	Becket,	8
H. E. Day,	Huntington,	8
William E. Smith,	North Chester,	8
J. M. Van Huyck,	Lee,	8
John R. Parker,	Savoy,	8
Sanborn G. Tenney,	Williamstown,	8
F. H. Saunders,	Westfield,	8
George L. Rindge,	North Wilbraham,	8
Joseph P. Love,	Webster,	8
H. Courtemanche,	Southbridge,	8
A. P. Morin,	North Brookfield,	8
William T. Nesbitt,	Chicopee,	8
E. W. Strecker,	Greenfield,	8
J. H. Schoonmaker,	Ware,	8
G. W. Wheelwright,	Hardwick,	8
J. H. Gafney,	Petersham,	8
Henry F. Rice,	Sutton,	8
F. S. Stockwell,	West Millbury,	8
Charles H. Goodell,	Worcester,	8
Elmer A. Macker,	North Grafton,	8
Frederick Saunders,	Westfield,	8
Clyde C. Hunt,	Medway,	8
J. Lewis McAuslan,	Berlin,	8
William G. Cummings,	Ware,	8
M. C. Needham,	Coldbrook,	8
Frank J. Knight,	Townsend,	8
Walter F. Durgin,	Hopedale,	8
George S. Potter,	Southbridge,	8
Dom Pocai,	Southbridge,	8
George J. Shumway,	Holyoke,	8
Sigmund Klaiber,	Turners Falls,	8
John C. Stone,	Athol,	8
D. W. Baker,	Phillipston,	8
Edward Miller,	Northampton,	8

Distribution of Pheasants — Continued.

Applicant.	Town.	Number.
Edward J. Norman,	Lee,	8
Travers D. Carman,	Tolland,	8
Charles A. Church,	Millbury,	6
Walter J. Stone,	Auburn,	6
T. B. Stevenson,	Manchaug,	6
George E. Brigham,	Worcester,	6
W. H. Buck,	Oxford,	6
M. E. Turner,	Chester,	6
George L. Brown,	Littleton,	6
J. G. Waters,	Salem,	4
B. Frank Smith,	Andover,	4
Harrison G. Blake,	Woburn,	4
Charles H. Wood,	Bedford,	4
Warren Beede,	Lynn,	4
LeRoy Parkhurst,	Chelmsford,	4
Fred W. Cheney,	Rowley,	4
E. A. Carpenter,	North Reading,	4
South Acton Fish and Game Association,	South Acton,	12
Paul O. Kable,	North Chelmsford,	6
George W. Alcott,	Lowell,	6
Henry L. Sawyer,	Fitchburg,	6
J. A. Barton,	Fitchburg,	6
John W. Wheeler,	Orange,	6
Nathan F. Ives,	Rowley,	6
William T. Jeffrey,	Salem,	6
C. W. Hicks,	Waltham,	6
James Rourke,	Lynnfield Center,	6
R. F. Goddard,	Woburn,	6
M. F. Holt,	Wilmington,	6
Charles H. Wood,	Bedford,	6
W. H. Wickens,	Lawrence,	6
Thomas Croswell,	North Reading,	6
Arthur Bliss, Jr.,	Andover,	6
L. W. Prouty and F. P. Hewins,	South Framingham,	6
Brockton Fish and Game Association,	Brockton,	6
E. B. Nevin,	South Weymouth,	6
James McGrady,	Lawrence,	8
William A. Thom,	Methuen,	8
Oliver K. Pierce,	Ayer,	8
Thomas H. Varnum,	Lowell,	8
Charles E. Abare,	Dracut,	8
Albert T. Hodges,	Mansfield,	8
Edgar L. Freeman,	Medway,	8
Harry G. Frost,	Waltham,	8
Fred F. Trull,	Hudson,	8
Richard P. Waters,	Wenham,	8
J. C. Todd,	Newburyport,	8

Distribution of Pheasants — Concluded.

Applicant.	Town.	Number.
W. B. Cross,	Brockton,	8
Paul O. Kable,	Tyngsborough,	8
Albert W. Lewis,	Fall River,	8
Charles W. Davol,	Taunton,	8
Norman Barstow,	New Bedford,	8
L. H. Bartlett,	Boxford,	8
Thomas A. McDonald,	Gloucester,	8
George B. Lord,	Melrose,	8
Weldon H. Reynolds,	Braintree,	8
L. D. Baker, Jr.,	Wellfleet,	8
Alexander Pope,	Hingham,	8
John Cary Spring,	Gloucester,	8
Henry E. Garfield,	South Yarmouth,	8
W. M. Small,	North Truro,	8
Henry O. Whiting,	Plymouth,	8
William T. Corey,	New Bedford,	8
Dexter E. Wadsworth,	Quincy,	8
W. W. Bradbury,	Lawrence,	6
D. E. Halley,	Lawrence,	6
George H. Doty,	Waltham,	8
Henry A. Barton,	Dalton,	8
Rufus W. Page,	Newburyport,	8
M. E. S. Clemons,	Wakefield,	8
H. E. Guy,	Brockton,	8
Harry E. Converse,	Marion,	7
Edward W. Grew,	Farm Street,	8
Fitchburg Rifle and Gun Club,	Fitchburg,	6
Charles F. Cowdry,	Fitchburg,	6
C. C. Puffer,	Brockton,	3
		826

[D.]

Distribution of Belgian Hares.

Applicant.	Town.	Number.
J. A. Barton,	Fitchburg,	7
James H. O'Hara,	Greenfield,	7
John T. Montgomery,	Ware,	7
Sanborn G. Tenney,	Williamstown,	7
James Coe, Jr.,	Taunton,	7
		35

[E.]

Arrests and Convictions.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
John Frates,	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Discharged,	–	
Peter Godak,	New Bedford,		Convicted,	$10 00	
Manuel Souza,	New Bedford,		Convicted,	10 00	
Antone Souza,	New Bedford,		Convicted,	10 00	
Antoine Silvia,	New Bedford,		Convicted,	10 00	
John Thomas,	Fairhaven,		Convicted,	10 00	
Frank Nunes,	New Bedford,		Convicted,	–	Filed.
Augusto Bibeiro,	New Bedford,		Convicted,	10 00	
Antone Domingo,	Fairhaven,		Convicted,	10 00	
Zadie Cutting,	Quincy,		Convicted,	10 00	
Neils Nelson,	North Weymouth,		Convicted,	10 00	
Hans Christensen,	Hull,		Convicted,	10 00	
James Barnes,	Hull,		Convicted,	10 00	
Frank Smith,	Hull,		Convicted,	–	Filed.
James Smith,	Hull,		Convicted,	10 00	
Lewis Johnson,	North Weymouth,		Convicted,	10 00	
Henry Moebs,	Quincy,		Convicted,	10 00	
Walter Dunn,	Dorchester,		Convicted,	5 00	
Harry H. Barry,	Dorchester,		Convicted,	5 00	
Fred W. Perkins,	Dorchester,		Convicted,	5 00	
William H. Wakeham,	South Boston,		Convicted,	–	Filed.
Charles DeRocher,	New Bedford,		Convicted,	10 00	
John Jyminski,	New Bedford,		Convicted,	10 00	
Joseph Doproski,	New Bedford,		Convicted,	10 00	
Zachariah Caldwell,	New Bedford,		Convicted,	–	Filed.
John J. Tearr,	New Bedford,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Christopher Kirtscher,	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Convicted,	$50 00	Committed to jail; third offence.
Augustine Allen,	New Bedford,		Convicted,	10 00	
Victor Langlois,	New Bedford,		Convicted,	10 00	
Joaquin Cidae,	New Bedford,		Convicted,	10 00	
Jacob E. Martin,	Fairhaven,		Convicted,	10 00	
Mike Mack,	Fairhaven,		Convicted,	10 00	
Bolus Monte,	Fairhaven,		Convicted,	10 00	
Joseph Arsenault,	New Bedford,		Convicted,	10 00	
Aime Breault,	New Bedford,		Convicted,	10 00	
Jack Rose,	Fairhaven,		Convicted,	15 00	
Antone Avila,	Fairhaven,		Discharged,	–	
Fred Cormier,	New Bedford,		Convicted,	10 00	
Michael LeBlanc,	Fairhaven,		Convicted,	15 00	
Frank Joseph,	New Bedford,		Convicted,	15 00	
Amede Ganyon,	New Bedford,		Convicted,	10 00	
Henry Marcotte,	New Bedford,		Convicted,	10 00	
George Fisher,	New Bedford,		Convicted,	10 00	
Marian Tavares,	New Bedford,		Convicted,	10 00	
John Bisquit,	New Bedford,		Convicted,	10 00	
Jules Gomes,	New Bedford,		Convicted,	10 00	
Antone Cardosa,	New Bedford,		Convicted,	10 00	
August Costa,	New Bedford,		Convicted,	10 00	
Manuel Fonseca,	New Bedford,		Convicted,	10 00	Appealed.
Joseph Lavasurio,	New Bedford,		Convicted,	10 00	
Henry Glader,	New Bedford,		Convicted,	10 00	
Howard Olson,	New Bedford,		Convicted,	10 00	
Elmer E. Gifford,	Fairhaven,		Convicted,	10 00	House of correction.
Joseph Manuel,	New Bedford,		Convicted,	10 00	
Manuel Mello,	New Bedford,		Convicted,	10 00	
Antone Jasman,	New Bedford,		Convicted,	10 00	
Chris Knutcher,	New Bedford,		Convicted,	10 00	
William H. Bryant,	New Bedford,		Convicted,	10 00	
Thomas A. Taylor,	New Bedford,		Convicted,	10 00	
Joseph Delano,	New Bedford,		Convicted,	10 00	
Antoine Poirier,	New Bedford,		Convicted,	10 00	
Manuel Veira,	New Bedford,		Convicted,	10 00	
Marion de Silva,	New Bedford,		Convicted,	10 00	
Frank Costa,	New Bedford,		Convicted,	15 00	
Antone Grosse,	New Bedford,		Convicted,	–	Filed.
Benjamin N. Chase,	New Bedford,		Convicted,	50 00	Second offence.
Albano Ferreira,	Fairhaven,		Convicted,	10 00	

Victor Langlois,	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Convicted,	50 00	
Antone Furtado,	New Bedford,		Convicted,	10 00	
Manuel Costa,	New Bedford,		Convicted,	10 00	
John Cawalho,	New Bedford,		Convicted,	10 00	
John Brown,	New Bedford,		Convicted,	10 00	
Manuel S. Brown,	New Bedford,		Convicted,	10 00	
Joseph Cabral,	New Bedford,		Convicted,	10 00	
Manuel Amaral,	New Bedford,		Convicted,	10 00	
Manuel Mederious,	New Bedford,		Convicted,	10 00	
Manuel Coneria,	New Bedford,		Convicted,	10 00	
Joseph Patrice,	New Bedford,		Convicted,	10 00	
Salvato N. Terditte,	Randolph,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Convicted,	10 00	
Joseph Saraquso,	Framingham,		Convicted,	–	Filed.
John Stevens,	Newburyport,		Convicted,	10 00	
Charles Richardson,	Newburyport,		Convicted,	10 00	
Fred Bush,	Newburyport,		Convicted,	10 00	
William R. Pazolt,	Brookline,		Convicted,	10 00	
Leroy Slate,	Nahant,		Convicted,	12 00	
Foster Christie,	Jamaica Plain,		Convicted,	12 00	
Sidney Christie,	Roxbury,		Convicted,	12 00	
Peter Sistara,	Lee,		Convicted,	10 00	
Gelmini Bosilio,	Lee,		Convicted,	10 00	
Irving Hennessy,	Dorchester,		Convicted,	10 00	
Harold P. Gurney,	Whitman,		Convicted,	10 00	
George Raymond,	Boston,		Convicted,	10 00	
John H. Parks,	Attleborough,		Convicted,	10 00	
Harry T. Peckham,	Attleborough,		Convicted,	10 00	
Joseph M. Carew,	Boston,		Convicted,	10 00	
Walter C. Howard,	Marlborough,		Convicted,	10 00	
E. Guy Howard,	Marlborough,		Convicted,	10 00	
Albert D. Waterman,	Rehoboth,		Convicted,	–	Filed by request.
Kenard Winsor,	Boston,		Convicted,	10 00	
Charles A. Safford,	Newburyport,		Discharged,	–	
H. C. Noyes,	Newburyport,		Discharged,	–	
Alfred Lorenzo,	Gloucester,		Discharged,	–	
Charles A. Martin,	Gloucester,		Discharged,	–	
Edward Churchill,	Lexington,		Convicted,	–	Probation six months.
Fred J. Buckley,	Canton,		Discharged,	–	
Charles Church,	East Saugus,		Convicted,	10 00	
David H. Sullivan,	Lynn,		Convicted,	10 00	
William H. Packard,	Brockton,		Convicted,	10 00	
William B. Foster,	Brockton,		Convicted,	10 00	
Henry E. Johnson,	Brockton,		Convicted,	10 00	
Edgar F. Tracy,	Worcester,		Convicted,	–	Filed.
Ray F. Fowler,	Westfield,		Convicted,	–	Filed.
George Janiska,	Templeton,		Convicted,	–	Filed.
James P. Flaherty,	Hopkinton,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Davis Stoddard,	North Hanover,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Convicted,	$10 00	
Fred Martin,	Greenfield,		Convicted,	10 00	
John Fritz,	Greenfield,		Convicted,	–	Filed.
Jacob Koch,	Greenfield,		Convicted,	10 00	
Fred Atkinson,	Lawrence,		Convicted,	10 00	
James McGrady,	Lawrence,		Convicted,	10 00	
James McGrady, Jr.,	Lawrence,		Convicted,	10 00	
Jimmie South,	Waltham,		Convicted,	10 00	
Camelo Casselo,	Waltham,		Convicted,	10 00	
John Wzacan,	Three Rivers,	Hunting without license in violation of c. 317, Acts of 1905,	Discharged,	–	
Frank Gonsalves,	New Bedford,		Convicted,	10 00	
John Barszcz,	Pittsfield,		Convicted,	10 00	
Paul Schmid,	Greenfield,		Convicted,	10 00	
Jerry Cargo,	Fitchburg,		Convicted,	20 00	Filed in Superior Court; paid $50 fine for assault.
Victor Antonio,	Fitchburg,		Convicted,	20 00	
Antonio Graber,	Fitchburg,		Convicted,	20 00	Filed in Superior Court; paid $50 fine for assault.
Michael Pettagemie,	Fitchburg,		Convicted,	10 00	
Frank Castalano,	Sharon,		Convicted,	–	Filed; see killing song birds.
Agabito Sciano,	Becket,		Convicted,	20 00	
Dominico Morgida,	Revere,		Discharged,	–	
Salvato N. Terditte,	Randolph,		Discharged,	–	
Hajime Koyosu,	Revere,		Convicted,	10 00	
Hamparsum Asturian,	Whitinsville,		Convicted,	10 00	
Alfonso Monaldo,	Pittsfield,		Convicted,	15 00	
Joseph Parisi,	Pittsfield,		Convicted,	10 00	
Steve Uzdaninis,	Brockton,		Convicted,	10 00	
Pasquale Viloni,	Braintree,		Convicted,	10 00	
Gandolfs Rosolina,	Randolph,		Convicted,	10 00	
Rosario Campagnio,	Braintree,		Convicted,	10 00	
Toney Ross,	Boston,		Convicted,	10 00	
Peter Nociti,	Brockton,		–	–	Defaulted.
Joseph Kalowsky,	Lexington,		Convicted,	10 00	
John Gromocopoulos,	–		Convicted,	15 00	
Thomas Drokos,	–		–	–	Defaulted.
Paul Spinachola,	Framingham,		Convicted,	10 00	
Eugene LaRoche,	Haverhill,		Convicted,	–	Filed.
George Janiska,	Templeton,		Convicted,	15 00	
Frederico Paraboschi,	Boston,		Convicted,	10 00	
Amos Hatt,	Hamilton,		Convicted,	10 00	

George Turco,	Boston,	Illegal possession of game,	Convicted,	10 00	
William C. Long,	Orleans,		Discharged,	–	
Frederick Higgins,	Orleans,		Discharged,	–	
Jonathan Ryder,	Orleans,		Discharged,	–	
Andrew Harvey,	Easton,		Convicted,	20 00	
Joseph Saraquso,	Framingham,		Convicted,	30 00	
Fred J. Baker,	Holyoke,		Convicted,	20 00	
James H. Taber,	Acushnet,		Convicted,	60 00	
William Richardson,	Scituate,		Convicted,	10 00	
William R. Pazolt,	Brookline,		Convicted,	10 00	
Gustave R. Mauritz,	Norwood,		Convicted,	10 00	
Carlo Cataldo,	Fitchburg,		Convicted,	10 00	
William B. Foster,	Brockton,		Convicted,	20 00	
Henry E. Johnson,	Brockton,		Convicted,	20 00	
Benjamin A. Lucas,	Sharon,		Convicted,	20 00	
Frederico Paraboschi,	Boston,		Convicted,	10 00	
Ambrose Stevens,	Spencer,		Convicted,	10 00	
James P. Flaherty,	Hopkinton,		Convicted,	10 00	
Epifanio Coco,	Charlestown,		Convicted,	10 00	
George W. Whitney,	Lowell,	Fishing in closed ponds in violation of § 19, c. 91, R. L., as amended by c. 306, Acts of 1907,	Convicted,	5 00	
Frank E. Bassett,	Lowell,		Convicted,	5 00	
John Lilla,	Webster,		Convicted,	7 00	
Robert Noack,	Webster,		Convicted,	7 00	
James Bryne,	Boston,		Discharged,	–	
Charles Willect,	Whitman,		Convicted,	–	Filed; paid $3 costs of court.
Melvin Broad,	Brockton,		Convicted,	10 00	
George F. Homan,	Suffield, Conn.,		Convicted,	20 00	
William Emerson,	Lynn,		Convicted,	20 00	
Harry E. Kelley,	Lynn,		Convicted,	20 00	
Hector Lamoge,	Fitchburg,		Convicted,	10 00	
Adelard Gunette,	Fitchburg,		Convicted,	10 00	
Joseph Hardina,	Westfield,		Convicted,	20 00	
David Burke,	Westfield,		Convicted,	–	Filed.
George T. Palmer,	Westfield,		Discharged,	–	
H. L. Laurie,	Boston,		Convicted,	–	Filed.
H. Robert Kaufmann,	Halifax,		Convicted,	–	Filed.
Walter Schweitzer,	Boston,		Convicted,	–	Filed.
Albert D. Beardsley,	Halifax,		Convicted,	20 00	Appealed.
Archie R. French,	East Weymouth,		Convicted,	–	Filed; paid 45 cents costs of court.
Frank C. Hall,	East Weymouth,		Convicted,	–	Filed; paid 45 cents costs of court.
Clinton J. Leslie,	Great Barrington,		Convicted,	5 00	
Clinton J. Gilmore,	Great Barrington,		Convicted,	5 00	
Raymond A. Vigeant,	South Lee,		Convicted,	5 00	
J. W. Boyd,	South Lee,		Convicted,	5 00	
Leonard Saunders,	Andover,		Discharged,	–	
George W. Saunders,	Andover,		Convicted,	5 00	
John A. Marsel,	Southbridge,		Discharged,	–	
Thomas Thumblin,	Southbridge,		Convicted,	20 00	
William H. Guinan,	Northampton,		Convicted,	–	Filed.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State v.—	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Walter D. Fisher,	Hopkinton,	Fishing in great ponds in violation of § 26, c. 91, R. L., as amended by c. 308, Acts of 1904,	Convicted,	$20 00	
George F. Manning,	Hopkinton,		Convicted,	20 00	
Michael Banish,	Palmer,		Convicted,	20 00	
Joseph Brouthers,	Palmer,		– –	–	Case pending.
Henry Moro,	Mansfield,		Convicted,	20 00	
Thomas Guerra,	Mansfield,		Convicted,	20 00	
George E. Ramsdell,	Reading,		Convicted,	–	Filed.
John Trucott,	Haverhill,		Convicted,	–	Filed.
John B. Ouilette,	Tiverton, R. I.,	Having short lobsters in violation of § 88, c. 91, R. L., as amended by c. 303, Acts of 1907,	Convicted,	15 00	
Morton Robbins,	Plymouth,		Discharged,	–	
Lindley W. Mayhew,	West Tisbury,		Convicted,	25 00	
George Robbins,	Hyannis,		Convicted,	25 00	
Herbert O. Bacon,	Hyannis,		Convicted,	10 00	
Demeters Jeanes,	New Bedford,		Convicted,	10 00	
John L. Oikel,	Lynn,		Convicted,	5 00	
Manuel Silva,	New Bedford,		Convicted,	50 00	
Clayton F. Baker,	Brockton,		Discharged,	–	
William H. Stewart,	Nahant,		Convicted,	28 00	
Albert White,	Onset,		Convicted,	15 00	
Daniel S. Webber,	Gloucester,		Convicted,	–	Filed.
Gabriel J. Erickson,	Rockport,		Convicted,	10 00	
Rodney A. Douglass,	Swampscott,		Convicted,	17 50	
Manuel C. Mitchell,	Gloucester,		Convicted,	7 00	
Benjamin Hodges,	Chiltonville,		Convicted,	5 00	
Emil Hanson,	Cambridge,		Convicted,	15 00	
George C. Hollister,	Granville,	Having short trout in possession in violation of § 64, c. 91, R. L., as amended by c. 190, Acts of 1905,	Convicted,	10 00	
Horace Plue,	Adams,		Convicted,	10 00	
Patrick Kelley,	East Walpole,		Convicted,	40 00	House of correction for non-payment.
H. H. Fogg,	Dorchester,		Convicted,	10 00	
Russell F. Phelps,	North Adams,		Convicted,	10 00	Appealed.
Nathan W. Willis,	Foxborough,		Convicted,	10 00	
Crawford Linton,	Boston,		Convicted,	40 00	
Frank Greer,	Charlemont,		Convicted,	10 00	
George H. St. John,	Hartford, Conn.,		Convicted,	30 00	
Louis C. Hathaway,	Hartford, Conn.,		Convicted,	30 00	
Horace B. Bailey,	Gill,		Convicted,	10 00	

Louis Siano,	Springfield,	Killing song birds in violation of § 7, c. 92, R. L., as amended by c. 250, Acts of 1907,	Convicted,	10 00	
Frank Castalano,	Sharon,		Convicted,	10 00	
Harry Cull,	Woronoco,		Convicted,	10 00	
Thomas P. Collins,	Woronoco,		Convicted,	10 00	
Charles McGrath,	West Quincy,		Convicted,	2 00	
Frank G. Cool,	Brockton,		Convicted,	2 00	
Patrick Albano,	Springfield,		Convicted,	–	Continued from day to day for six months.
John Massini,	Buckland,		Convicted,	10 00	
Alfonso Monaldo,	Pittsfield,		Convicted,	15 00	
Joseph Parisi,	Pittsfield,		Convicted,	10 00	
Steve Uzdaninis,	Brockton,		Convicted,	10 00	
Gandolfs Rosolina,	Randolph,		Convicted,	10 00	
Rosario Campagnio,	Braintree,		Convicted,	10 00	
Frederick L. Carpenter,	Boston,	Possession of feathers of certain birds for millinery purposes in violation of c. 329, Acts of 1903,	Convicted,	10 00	
Charles A. Mitchell,	Lowell,		Convicted,	2 00	
Samuel Goldenburg,	Lowell,		Convicted,	2 00	
Charles F. Underwood,	Haverhill,		Convicted,	3 00	
Estella A. Dwinnell,	Haverhill,		Convicted,	3 00	
Estella A. Dwinnell,	Haverhill,		Discharged,	–	
William F. Thayer,	Haverhill,		Convicted,	3 00	
Rose Keene,	Haverhill,		Convicted,	3 00	
Jenny A. Arnold,	Lynn,		Convicted,	10 00	
Emma B. Fellows,	Lynn,		Convicted,	10 00	
Patrick B. Magrane,	Lynn,		Convicted,	10 00	
H. B. Allen and Gertrude Cousens,	Lynn,		Convicted,	10 00	
Herbert P. Russell,	Worcester,		Discharged,	–	
John C. MacInnis,	Worcester,		Discharged,	–	
Joseph F. Sherer,	Worcester,		Discharged,	–	
Nils Bjork,	Worcester,		Convicted,	10 00	
Catherine Gallagher,	Worcester,		Convicted,	10 00	
Albert S. Lowell,	Worcester,		Discharged,	–	
Leo Hirsh,	Boston,		Convicted,	10 00	
Preston W. Johnson,	Lynn,		Convicted,	10 00	
Theresa Fitzpatrick,	Lynn,		Convicted,	–	Filed.
Catherine Morrill and Elizabeth Price,	Malden,		Convicted,	–	Filed.
Mary A. Murphy,	Quincy,		Convicted,	–	Filed; paid 10 cents costs of court.
Frances Cass,	Boston,		Convicted,	10 00	
Caroline A. Finneran,	Boston,		Convicted,	10 00	
Mary Murphy,	Boston,		Convicted,	10 00	
Antoinette Moyser,	South Boston,		Convicted,	–	Filed.
Ernest Manahan,	Boston,		Convicted,	10 00	
James T. Thompson,	Boston,		Convicted,	10 00	
Maisie B. McDermott,	Boston,		Convicted,	10 00	
John W. MacInnis,	Boston,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Samuel Callis,	Fall River,	Possession of feathers of certain birds for millinery purposes in violation of c. 329, Acts of 1903,	Convicted,	$10 00	
Catherine McCann,	Fall River,		Convicted,	10 00	
Samuel Robinson,	Fall River,		Convicted,	10 00	
Samuel Dudgeon,	New Bedford,		Convicted,	5 00	
Samuel Dudgeon,	New Bedford,		Convicted,	10 00	
Mrs. B. Grimshaw,	New Bedford,		Convicted,	5 00	
Mrs. B. Grimshaw,	New Bedford,		Convicted,	10 00	
M. J. Leahy,	New Bedford,		Convicted,	10 00	
Alice Casavant,	Fall River,		Convicted,	20 00	Two counts.
K. L. Goodwin,	Fall River,		Convicted,	10 00	
M. L. Boucher,	Fall River,		Convicted,	20 00	Two counts.
Mrs. Rena Murray,	Lynn,		Convicted,	10 00	
Mrs. Amelia Byrne,	Fall River,		Convicted,	10 00	
Miss Mary L. Renaud,	Fall River,		Convicted,	10 00	
Mrs. Louise Croisetiere,	Fall River,		Convicted,	10 00	
Philip Genensky,	New Bedford,		Convicted,	10 00	
Allen Beausang,	Boston,		Convicted,	10 00	
Calvin P. Sanger,	Boston,		Convicted,	10 00	
Joseph E. Paris,	New Bedford,		Convicted,	–	Filed; paid $3.80 costs of court.
Holman Forman,	Fall River,		Convicted,	10 00	
Samuel Macaroisky,	Fall River,		Convicted,	10 00	
Elizabeth Allaire,	Fall River,		Convicted,	10 00	
Angeline Gaudreau,	Fall River,		Convicted,	10 00	
John Small,	Webster,	Dogs chasing deer in violation of § 18, c. 92, R. L., as amended by c. 245, Acts of 1905,	Convicted,	10 00	
Arthur Townsend,	Webster,		Discharged,	–	
John Small,	Webster,	Killing deer in violation of § 17, c. 92, R. L., as amended by c. 307, Acts of 1907, and c. 377, Acts of 1908,	Discharged,	–	
Arthur Townsend,	Webster,		Discharged,	–	
Martin Lonergan,	Webster,		Discharged,	–	
William Barton,	Otis,		Convicted,	–	Filed.
William Moore,	Ayer,		Discharged,	–	Fined $100 each, which court afterwards revoked.
Andrew Kennedy,	Leominster,		Discharged,	–	
Francisco Roberto,	Palmer,		Convicted,	100 00	
Charles F. Williams,	Leverett,		Convicted,	–	Filed; paid $3.70 costs of court.
Manuel Silvia,	Freetown,		Convicted,	–	Filed.
Horace Sampson,	Shirley,		Convicted,	100 00	Committed to house of correction on non-payment.
Giuseppe Demario,	Deerfield,		Convicted,	100 00	
Saturni Borelli,	Deerfield,		Convicted,	100 00	
Charles Rich,	Ludlow,		Discharged,	–	
Allie R. Fisk,	Chester,		Discharged,	–	
Lawrence Sorenson,	Clinton,		Convicted,	100 00	

Levi Wright,	Franklin,	Setting forest fires in violation of c. 299, Acts of 1907,	Convicted,	–	Filed.
William L. Smart,	Franklin,		Convicted,	–	Filed.
Archie Coulomb,	Franklin,		Convicted,	–	Filed.
Charles Jaques,	Franklin,		Convicted,	–	Filed.
Walter Barnes,	Lynn,		Convicted,	–	Filed.
Allen Wheelden,	Lynn,		Convicted,	–	Filed.
Albert Barnes,	Lynn,		Convicted,	–	Filed.
David W. Whitmore,	Lynn,		Discharged,	–	
Henry Coburn,	Colrain,	Hunting with ferret in violation of § 11, c. 92, R. L., as amended by c. 241, Acts of 1906,	Convicted,	20 00	
Dellis Blue,	Indian Orchard,		Discharged,	–	
Tullis Duby,	Indian Orchard,		Discharged,	–	
Henry LaMountain,	Indian Orchard,		Discharged,	–	
Wilford Giroux,	Indian Orchard,		Discharged,	–	
Gideon Monett,	Indian Orchard,		Discharged,	–	
Emil Roth,	Greenfield,		Convicted,	20 00	
Paul Schmid,	Greenfield,		Convicted,	–	Filed.
Fred Martin,	Greenfield,		Convicted,	–	Filed.
John Fritz,	Greenfield,		Convicted,	20 00	
Jacob Koch,	Greenfield,		Convicted,	–	Filed.
Max Hamm,	Holyoke,	Having short pickerel in violation of § 67, c. 91, R. L., as amended by c. 329, Acts of 1904,	Convicted,	–	Filed.
John Hecker,	North Attleborough,		Convicted,	3 00	
Charles Follett,	North Attleborough,		Convicted,	3 00	
Stanley Ciseck,	North Attleborough,		Convicted,	1 00	
John Mastarowski,	North Attleborough,		Convicted,	1 00	
John E. Nagle,	Holyoke,		Convicted,	1 00	
Lewis Goff,	Attleborough,		Convicted,	2 00	
Isaac C. Chase,	Roxbury,		Convicted,	2 00	
John Patton,	Adams,		Convicted,	–	Filed.
Joseph Lavoie,	Fall River,	Having short bass in violation of § 70, c. 91, R. L.,	Convicted,	10 00	
Joseph Bennett,	Fall River,		Convicted,	10 00	
Arthur Beliveau,	Fall River,		Convicted,	10 00	
Jerry Parent,	Fall River,		Convicted,	10 00	
Oscar Herickson,	Providence, R. I.,		Convicted,	10 00	
Ernest Devaney,	Fall River,		Convicted,	10 00	
Berger Larson,	Providence, R. I.,		Convicted,	10 00	
Samuel Wilkinson,	Fall River,		Convicted,	10 00	
Louis Real,	Fall River,		Convicted,	10 00	
Isaac C. Chase,	Roxbury,		Convicted,	20 00	
Gilbert E. Golding,	Franklin,		Convicted,	10 00	
Charles H. Yale,	Fall River,		Convicted,	10 00	
A. J. Allen,	Fall River,		Convicted,	10 00	
Marshall F. Stevens,	East Weymouth,	Seining smelts in violation of §§ 72 and 74, c. 91, R. L.,	Convicted,	50 00	Given one month to pay; filed.
Charles J. Cook,	Worcester,		Convicted,	–	Filed; paid $20 costs of court.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Marshall F. Stevens,	East Weymouth,	Taking smelts in close season in violation of § 71, c. 91, R. L.,	Convicted,	$13 00	
Parker Rogers,	Brockton,		Convicted,	590 00	Appealed; paid $20 Superior Court.
John W. Curtis,	East Weymouth,		Convicted,	579 00	Appealed; paid $20 Superior Court.
Patrick Hanifan,	East Weymouth,		Convicted,	1,017 00	Appealed; still pending.
Joseph Pitts,	Weymouth,		Convicted,	20 00	
Eugene O'Connor,	Weymouth,		Convicted,	53 00	Appealed; still pending.
William McRea,	East Braintree,		Convicted,	–	Filed.
Harry Bowers,	East Braintree,		Convicted,	10 00	
James Bowers,	East Braintree,		Convicted,	10 00	
Frank T. Stewart,	East Braintree,		Convicted,	3 00	
Arthur C. Read,	Fall River,	Violation of c. 401, Acts of 1855,	Convicted,	–	Filed; paid $3.30 costs of court.
W. A. Read,	Fall River,		Convicted,	–	Filed; paid $4.76 costs of court.
Benjamin F. Yutz,	Fall River,		Convicted,	–	Filed; paid $3.38 costs of court.
W. E. Read,	Fall River,		Convicted,	–	Filed; paid $3.80 costs of court.
George C. Hollister,	Granville,	Having trout out of season,	Convicted,	10 00	
John Broko,	West Springfield,		Convicted,	10 00	
Dwight Cooley,	Dana Center,	Taking trout with net in violation of § 62, c. 91, R. L., as amended by c. 314, Acts of 1906,	Convicted,	25 00	
George F. Homan,	Suffield, Conn.,	Setting net in pond in violation of § 26, c. 91, R. L., as amended by c. 308, Acts of 1904,	Convicted,	20 00	
John D. Jordan,	Springfield,		Convicted,	20 00	
Charles F. Winslow,	Fall River,	Seining in violation of § 42, c. 91, R. L.,	Convicted,	20 00	
A. J. Lannigan,	Fall River,		Convicted,	20 00	
Charles E. Gardner,	Somerville,		Convicted,	–	Filed.
John A. Carter,	Petersham,	Sawdust pollution,	Convicted,	–	Filed; paid $7.11 costs of court.
John Johnson,	Lanesborough,	Spearing fish,	Convicted,	10 00	Fine suspended on good behavior.
Lindley W. Mayhew,	West Tisbury,	Having egg-bearing lobsters for sale in violation of § 86, c. 91, R. L.,	Convicted,	30 00	
Seymour Patterson,	Chatham,		Convicted,	20 00	
Bradford N. Bloomer,	Chatham,		Convicted,	10 00	
Morris Flower,	Boston,	Torching herring in violation of c. 298, Acts of 1908,	Convicted,	50 00	
Malto Russo,	Boston,		Convicted,	–	Filed.
Augustino Guiliano,	Boston,		Convicted,	–	Filed.
Antonio Carroll,	Boston,		Convicted,	–	Filed.
Eugene W. Graves,	Boston,		Convicted,	–	Filed.
Cologo Jeweller,	Boston,		Convicted,	50 00	
Jeannie Montanio,	Boston,		Convicted,	–	Filed.
Charles Perkins,	Boston,		Convicted,	–	Filed.
Herbert Wakeham,	Boston,		Convicted,	–	Filed.
Wilber Wakeham,	Boston,		Convicted,	50 00	

Steven S. Borden,	Springfield,	Using over one hook on stocked pond,	Convicted,	20 00	
John Reynolds,	Springfield,		Convicted,	20 00	
Walter Moran,	Southwick,		Discharged,	–	
Charles Ashton,	Springfield,		Convicted,	–	Filed.
Alfred Ashton,	Springfield,		Convicted,	–	Filed,
E. Hammond,	Haverhill,		Convicted,	5 00	
John O'Brien,	Haverhill,		Convicted,	5 00	
George Kittredge,	Haverhill,		Convicted,	5 00	
H. L. Laurie,	Boston,		Convicted,	–	Filed.
H. Robert Kaufmann,	Halifax,		Convicted,	–	Filed.
Ralph Cole,	Attleborough,		Convicted,	–	Filed.
James E. Holmes,	Norwood,		Convicted,	5 00	
John Campbell,	North Cambridge,		Convicted,	5 00	
Charles H. Rice,	Weymouth,		Convicted,	5 00	
John Thompson,	North Attleborough,		Convicted,	–	Filed.
William Bailey,	Sharon,		Convicted,	10 00	
John H. Parker,	Boston,		Convicted,	1 00	
John C. Knowles,	Lowell,		Convicted,	10 00	
James Carrigan,	Lowell,		Convicted,	10 00	
John Kostos,	–	Trapping fish in violation of § 132, c. 91, R. L.,	Convicted,	10 00	
George M. Besse,	East Wareham,	Having unmarked lobster car in violation of § 119, c. 91, R. L.,	Convicted,	–	Filed.
Ansell C. Bloomer,	Chatham,		Discharged,	–	
Clifford H. White,	Onset,	Capturing eagle in violation of c. 118, Acts of 1907,	Convicted,	20 00	
Roscoe Gibson,	Boston,		Discharged,	–	
Orville W. Crosby,	Orleans,		Discharged,	–	
Felix Gelinski,	Brockton,	Setting net in violation of § 132, c. 91, R. L.,	Convicted,	10 00	
Ignatius Kaminiski,	Brockton,		Convicted,	25 00	Appealed.
William H. Stewart,	Nahant,	Setting lobster pots in violation of § 92, c. 91, R. L.,	Convicted,	20 00	
Arthur Smith,	Nahant,		Discharged,	–	
Gardner Cunningham,	Nahant,		Convicted,	20 00	
Angus Smith,	Nahant,		Discharged,	–	
James S. Cunningham,	Nahant,		Convicted,	20 00	
Waitsell Goodwin,	Nahant,		Convicted,	20 00	
William Atwood,	Nahant,		Convicted,	20 00	
Burton Atwood,	Nahant,		Convicted,	20 00	
William R. McDowell,	Pasque Island,	Setting nets in Buzzard's Bay in violation of § 122, c. 91, R. L.,	Convicted,	25 00	
Frank J. McDowell,	Pasque Island,		Convicted,	25 00	
Harry B. Eldridge,	Harwich,	Taking birds' eggs in violation of § 7, c. 92, R. L., as amended by c. 250, Acts of 1907,	Convicted,	–	Filed.
Andrew Harvey,	Easton,	Refusing to show game, c. 255, Acts of 1908,	Convicted,	–	Filed.
Joel Downing,	South Hadley Falls,	Killing bittern or heron in violation of c. 244, Acts of 1903,	Convicted,	6 00	
Truman W. Douglass,	Kingston,		Convicted,	5 00	
Albert F. Wales,	Rutland,		Convicted,	–	Filed; paid $12 costs of court.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Henry C. Hallett,	Hyannis,	Having scallops in close season,	Convicted,	$20 00	
John A. Carlson,	Worcester,	Using set line in violation of § 132, c. 91, R. L., as amended by c. 492, Acts of 1908,	Convicted,	20 00	
Charles Mahn,	Worcester,		Convicted,	20 00	
John Rube,	Springfield,	Taking fish with sweep seine in violation of § 132, c. 91, R. L., as amended by c. 492, Acts of 1908,	Convicted,	–	Filed.
Hormiodas Forgitte,	Springfield,		Convicted,	15 00	
Fred Patineau,	Springfield,		Convicted,	–	Continued from day to day.
Almarse Forgitte,	Springfield,		Convicted,	15 00	
Anthony Doner,	Boston,	Pursuing wild fowl with power boat in violation of § 11, c. 92, R. L. as amended by c. 241, Acts of 1906,	Convicted,	20 00	
Arthur Pratt,	North Weymouth,		Convicted,	20 00	
William F. Whalen,	Attleborough,		Convicted,	20 00	
Edward T. Connolly,	Attleborough,		Convicted,	20 00	
Walter F. Balcom,	Attleborough,		Convicted,	20 00	
Henry I. Curtis,	Holland,	Sending game birds out of State in violation of § 21, c. 92, R. L.,	Convicted,	10 00	
William King,	Leicester,	Hunting out of season in violation of c. 441, Acts of 1908,	Convicted,	20 00	
Levi Dobson,	Rockport,	Setting 1½ inch mesh seine in Plum Island Sound in violation of § 48, c. 91, R. L.,	Convicted,	–	Filed.
Ernest Goodwin,	Rockport,		Convicted,	–	Filed.
Frederick B. Burke,	Boston,		Convicted,	–	Filed.
Frank G. Goodwin,	Rockport,		Convicted,	–	Filed.
William H. Goodwin,	Rockport,		Convicted,	25 00	
Peter Stamotokos,	New York, N. Y.,	Nonresident hunting without license in violation of § 1, c. 198, Acts of 1907,	Discharged,	–	
Everett Demoranville,	Acushnet,	Snaring game,	Convicted,	60 00	
Israel Hersey,	Beverly,	Hunting pheasants,	Convicted,	5 00	
Albert C. Giles,	Beverly,		Convicted,	5 00	
Edward B. Mackie,	Fairhaven,	Having seed scallops in violation of c. 297, Acts of 1907,	Convicted,	5 00	
John Desautels,	Fairhaven,		Convicted,	5 00	
Wilfred Beaulieu,	Fairhaven,		Convicted,	5 00	
Joseph Lawrence,	Fairhaven,		Convicted,	5 00	
Joseph C. Pittsley,	Fairhaven,		Convicted,	5 00	

[F.]

Returns from the Shore Pound and Net Fisheries for the Year 1908.

Apparatus employed.

Proprietor.	Town.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
Edward Holway,	Bournedale,	2	5	$350 00	1	$1,500 00	–	–
J. Eldridge & Son, Gilbert E. Ellis, A. S. Hall, James F. Higgins, D. A. Newcomb, Fred Young,	Brewster,	20	12	505 00	19	4,935 00	3	$60 00
George W. Crowell, R. A. Nickerson & Co., W. H. Patterson, Albert W. Smith,	Chatham,	1	4	595 00	7	2,575 00	14	95 00
E. C. Flanders & Co., Flanders & Look, Daniel W. West,	Chilmark,	15	16	1,260 00	11	9,500 00	–	–
Zenas H. Baker, Crowell Cold Storage Company,	Dennis,	15	10	1,015 00	5	3,500 00	–	–
E. D. Perry, Charles Gardner, Albertis F. Simmons,	Dighton,	17	10	585 00	–	–	10	680 00

Apparatus employed — Concluded.

Proprietor.	Town.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
David B. Pease and Allen Mayhew, E. R. Durkee,	Edgartown,	4	5	$65 00	1	$200 00	–	–
D. D. Diamond & Co., Linus S. Jeffers & Co., A. H. Vanderhoop Company, L. L. Vanderhoop & Co.,	Gay Head,	6	18	3,105 00	14	9,400 00	1	$15 00
Fuller A. Andrews, George W. Douglass, Thomas Douglass, H. W. Nelson, Alexander Sargent, Frank A. Tarr,	Gloucester,	17	17	4,960 00	1	1,500 00	11	2,150 00
Orin S. Crosby, Moses Sturges, Taylor Bros.,	Hyannis,	9	7	2,025 00	–	–	87	745 00
Edw. Heath Company,	Manchester,	3	5	350 00	1	1,500 00	–	–
H. D. Powell, (F. H. Johnson and others), Avard L. Smith, (R. A. Atwood and others),	Nahant,	12	7	1,400 00	4	6,000 00	–	–
A. J. Barrett & Co., Edward J. Fisher, C. S. Glidden, George H. Hamblin, Arthur McCleare, Alexander C. Swain, John S. Watkins, George M. Winslow,	Nantucket,	21	24	6,485 00	6	3,000 00	221	3,490 00
C. A. Caswell & Co.,	Newburyport,	10	12	3,200 00	–	–	6	1,040 00
Atkins Hughes & Co., Fred C. Rich (agent),	North Truro,	26	14	3,690 00	10	21,240 00	–	–
Allen R. Norton, agent,	Oak Bluffs,	7	–	–	–	–	–	–
Warren Cove Weir Company,	Plymouth,	3	3	520 00	1	1,000 00	1	800 00

James F. Atkins,								
Manuel Carter,								
R. W. Cook,								
A. L. Daggett,								
Eastern Weir Company,								
C. H. Emery,								
Joseph H. Emery,								
Prince Freeman,								
James W. Fuller,								
Luther P. Hatch,								
William Josephs,								
James E. Kelley,								
A. P. Lewis and Manuel James,	Provincetown,	56	57	18,178 00	10	8,500 00	602	6,335 00
Thomas J. Lewis,								
William B. Lewis,								
Alfred A. Mayo,								
Herman L. Mayo,								
Frank I. Sears,								
Edwin W. Smith,								
John S. Smith,								
John R. Swartz,								
Manuel P. Vera,								
William M. Wareham,								
J. W. Weeks,								
Jackson R. Williams,								
J. P. Woods,								
G. B. Williams,	Raynham,	16	4	200 00	-	-	2	200 00
Melvin Rich,	Rockport,	3	3	330 00	-	-	10	50 00
Eugene W. Haines,	Sandwich,	3	3	390 00	1	1,000 00	-	-
A. W. Goff,	Segregansett,	12	4	150 00	-	-	4	200 00
J. H. Miller,	Somerset,	10	3	130 00	-	-	2	300 00
Henry W. Daggett,								
Obed S. Daggett,								
George H. Luce,	Tisbury,	15	26	2,290 00	14	4,500 00	-	-
H. Nelson Luce,								
W. L. and G. F. Tilton,								
John R. Walker,								
George C. Cleveland,								
Eben Luce,	Vineyard Haven,	4	10	1,440 00	9	3,150 00	-	-
Otis B. Luce,								
Jonathan Usher, Jr.,	Yarmouthport,	2	1	10 00	1	200 00	1	2 00
Totals for State,		309	280	$53.328 00	116	$83,200 00	975	$16,162 00

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.
Bournedale,	-	-	-	290	-	-	-
Brewster,	63,140	324	34,242	850	-	-	-
Chatham,	500	320	20,900	1,751	-	-	-
Chilmark,	25	-	15,572	9,193	-	40	-
Dennis,	19,500	484	3,400	929	-	-	-
Dighton,	124,452	-	-	-	-	-	-
Edgartown,	-	-	2,300	4,400	-	-	-
Gay Head,	40,000	-	5,500	11,070	-	-	-
Gloucester,	196,415	1,015	-	2,693	-	246,337	-
Hyannis,	-	834	9,000	5,500	-	-	-
Manchester,	10,600	-	-	755	-	41,967	-
Nahant,	-	-	-	-	100	2,400	-
Nantucket,	-	20,793	6,556	61,883	-	156,570	-
Newburyport,	-	-	-	-	-	160,168	-
North Truro,	418,600	850	68,770	13,262	-	130,520	-
Oak Bluffs,	-	-	-	-	-	-	-
Plymouth,	-	200	-	200	-	-	23
Provincetown,	10,000	1,430	482,278	186,178	-	29,430	-
Raynham,	226,400	-	-	-	-	-	-
Rockport,	-	-	-	-	-	1,620	-
Sandwich,	-	-	-	1,180	-	-	-
Segregansett,	55,000	-	-	-	-	-	-
Somerset,	72,000	-	-	-	-	-	-
Tisbury,	19,500	4,120	12,350	1,525	-	4,650	-
Vineyard Haven,	20,000	26	6,660	450	200	-	-
Yarmouthport,	-	-	400	-	-	1,000	-
Totals for State,	1,276,132	30,396	667,928	302,109	300	774,702	23

in Nets, Pounds, Traps, etc.

Scup.	Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Value.
–	–	–	–	–	–	41,625	1,941	–	$404 39
–	–	120,079	50	5,084	22	6,870	696	30,830	2,952 67
350	–	6,000	60	3,000	20	150,000	–	–	2,352 51
71,512	1,667	450	–	89,677	–	7,595	54	126,875	9,695 46
–	–	21,650	134	1,685	–	218,500	–	99,900	3,972 82
–	–	–	3,529	–	–	–	–	5,898	2,153 92
400	–	–	–	7,700	–	6,600	–	1,100	709 00
166,000	9,300	–	–	64,750	–	6,250	–	1,240	10,973 20
–	10	257,902	25,627	–	–	42,335	82	649,634	6,753 83
–	–	–	–	5,828	–	–	–	–	1,349 00
1,203	–	72,400	264	–	–	7,000	180	224,422	2,285 97
–	–	608,150	–	–	–	1,200	–	338,582	12,751 57
21,398	1,000	3,400	2,600	54,143	–	2,250	–	39,908	22,508 44
–	–	39,500	–	–	–	–	–	151,617	3,462 94
–	–	988,620	2,826	1,250	–	799,100	–	1,582,146	27,557 01
–	–	–	–	–	–	–	–	1,000	160 00
–	–	–	–	–	–	6,400	100	1,000	110 00
–	–	501,300	8,000	1,900	–	540,315	–	710,859	38,611 72
–	–	–	1,210	–	–	–	–	–	2,332 50
–	–	–	–	–	–	2,500	–	16,959	489 27
–	–	–	390	15	–	23,513	–	165	283 42
–	–	–	4,500	–	–	–	–	12,000	1,120 00
–	–	–	354	–	–	–	–	–	1,010 80
42,325	600	–	50	119,890	–	3,225	9,245	500	8,612 52
11,000	250	–	–	39,982	–	7,800	–	1,590	3,309 85
–	–	–	–	–	–	–	–	3,175	199 05
314,188	12,827	2,619,451	49,594	394,904	42	1,873,078	12,298	3,999,400	$166,121 86

Returns from the Lobster Fisheries.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
M. W. Springer,	Allerton,	1	1	$30 00	21	$30 00	553	$125 00	–
Charles Neil,	Beachmont,	1	3	455 00	75	200 00	5,088	1,017 60	11
A. J. Chandler, Frank C. Leonard, Perry H. Marsh, Albert Nightingale, L. L. Nightingale,	Bournedale,	5	7	450 00	255	295 00	11,117	1,369 98	63
H. M. Greene, Joacquin Perry, Manuel Serrilla, Antonio P. Silva, Tony Perry, John Pinto,	Boston,	6	11	925 00	735	735 00	21,820	4,286 30	362
A. L. Manter, George Pardy, H. W. Tolman, Julius E. White,	Brant Rock,	5	7	462 00	290	580 00	11,117	1,331 24	42
Fred W. Baker, Samuel Dill, Francis Hutchings, James E. Jones, R. A. Nickerson & Co., Wilbur F. Patterson, Benjamin F. Rich, Albert W. Smith, George W. Bloomer,	Chatham,	14	16	1,962 00	44	383 50	7,306	1,929 02	280
Roy E. Cottle, Jerry Look, William S. Mayhew, Everett A. Poole, Albert E. Reed, Harry G. Reed, Charles W. Ryan, Austin E. Smith, Onslow Stewart, J. D. and F. P. Tilton,	Chilmark,	13	16	2,666 00	576	800 00	37,367	4,539 59	505

Joseph Boutin, Ernest Johns, Henry A. Jordan, Whitman Nickerson, Charles H. Pierce, Charles Rogers, H. S. Sampson, John W. Sampson, R. L. Swift, L. S. Thurston,	Chiltonville,	10	21	982 00	544	947 00	27,510	3,457 15	114
John Eltman, Antone Grasse, Patrick Grasse, John W. Hunt, Andrew Peterson, Orne Peterson, Manuel S. Trombas, Levi Cadose,	Cohasset,	8	14	2,199 00	1,050	1,435 00	37,307	6,988 51	705
J. F. Cornell, Matthew R. Goulett, Isaac Gregory, Irvin Hall & Co., Alton Harrison, Samuel Jackson, George C. King, Frank Peters, Russell W. Rotch, Roland S. Snow, Oscar H. Stetson, J. H. Tilton, Chester F. Veeder, E. G. and H. S. Veeder, John Wall,	Cuttyhunk,	26	37	12,133 00	1,862	2,192 50	140,146	14,552 35	1,330
Samuel P. Burgess, Lamist Reynolds, Frank E. Wadsworth, S. G. T. Wadsworth,	Duxbury,	4	8	70 00	350	540 00	20,448	3,002 50	124
Edwin H. Burnham,	Essex,	1	1	100 00	20	20 00	1,625	247 00	–
Manuel Deloura,	Edgartown,	1	1	15 00	5	5 00	85	12 75	2
Harry M. Berry, Alvin F. Bourne, F. J. Densmore, Mayhew C. Stuart,	Falmouth,	4	6	280 00	59	87 00	674	193 25	22

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Moses P. Cooper,									
T. E. Haskins,	Gay Head,	4	7	$540 00	170	$170 00	6,815	$579 80	378
Joseph A. Lang,									
C. H. Ryan,									
Edward L. Ashley,									
Carl A. Dixon,									
Joseph Douglass,									
William Gallagher,									
Peter Knutson,									
D. E. Mehlmann,									
Jerry Phillips,									
Henry W. Pitzold,									
E. D. Rust,	Gloucester,	19	30	2,010 00	1,008	1,087 75	28,828	5,094 59	149
E. L. Small,									
Arthur Stevens,									
Manuel Viator,									
Daniel S. Webber,									
Manuel Cardozo,									
Nelson F. King,									
J. N. Christensen,									
Walter E. Marchant,									
Ansell P. Howes,									
Seth H. Howes,	Dennis,	4	4	70 00	83	70 50	1,706	370 17	90
O. H. Shiverick,									
Benjamin Walker,									
Robert Brown,									
W. M. Cushing,									
W. M. Englestead,									
George W. Gardner,									
Charles E. Peterson,									
Charles R. Peterson,	Green Harbor,	13	25	5,531 00	1,274	2,582 00	82,632	12,588 16	467
Lyman Sears,									
A. I. Shaw,									
W. H. Tolman,									
George Delano,									
Wilfred Keene,									
H. P. Tolman,									

Hulver M. Gillerson,									
Walter F. Kelley and B. Atwood,									
Ambrose B. Mitchell,	Hull,	7	9	776 00	535	850 00	29,140	5,310 91	67
Fred C. Maunch,									
R. M. Cleverly,									
Elmer W. Phinney,									
George W. Sturges,	Hyannis,	2	3	130 00	56	36 00	1,206	242 44	15
O. S. Crosby,									
Allen R. Gorham,	Kingston,	1	1	500 00	65	100 00	3,330	626 73	11
Edward M. Poland,									
Alfred W. Riley,	Lanesville,	4	5	180 00	175	155 00	7,250	1,199 30	31
George H. Woodbury,									
Addison H. Woodbury,									
D. C. Jones,	Manchester,	2	2	120 00	75	75 00	1,529	268 44	60
L. O. Sargent,									
Walter E. Bowman,	Mattapoisett,	1	2	215 00	110	137 00	5,082	591 62	302
James Anderson,									
C. D. Bacon,									
Edwin H. Bartlett,									
Samuel H. Benson,									
G. L. Binney,									
G. A. Bouvier,									
Laban B. Briggs,									
James E. Burke,									
Joseph E. Cook,									
Charles A. Dixon,									
C. H. Dixon,									
Archie Fenton,									
Emil A. Hammerquist,	Manomet,	30	45	3,835 00	1,715	2,796 00	93,626	12,077 95	442
Clarence A. Holmes,									
Ralph B. Holmes,									
G. A. Manter,									
W. J. Nightingale,									
Austin E. Parris,									
F. R. Peterson,									
Charles W. Raymond,									
J. E. Raymond,									
Robert Richardson,									
A. C. Sampson,									
Allen R. Swift,									
Guy D. Thomas,									
C. A. Wakefield,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Clinton F. Adams,									
W. F. Allen,									
Charles O. Briggs,									
J. E. Brown,									
Ernest E. Cronk,									
W. F. Dennis,									
William Dixey,									
B. F. Doliber,									
Arthur D. Frost,									
William T. Gardner,									
Thomas P. Gilbert,									
John W. Giles,									
Everett S. Hamson,									
George K. Hamson, Jr.,									
R. C. Hiller,									
David P. Howe,									
P. H. Keenan,									
Thomas P. Lyons,									
John W. Mace,	Marblehead,	41	53	$8,377 50	1,717	$2,153 65	133,890	$23,064 21	587
James H. Magee,									
George W. Mason,									
William F. Merritt,									
Harry A. Oliver,									
Everett P. Peach,									
Joseph S. Phillips,									
Augustus K. Roundy,									
Richard F. Russell,									
S. Q. Smith,									
William T. Smith,									
C. H. Smithurst,									
Ebenezer E. Snow,									
Clarence K. Stone,									
Samuel A. Stone,									
Benjamin H. Swett,									
Richard F. Farry,									
John F. Trefry,									
William H. Tutt,									

J. K. Gannett, Jr.,									
C. H. Pratt,									
Eugene Pratt,	Minot,	4	5	365 00	170	275 00	16,288	1,768 86	127
James J. Leary,									
Burton Atwood,									
E. H. Crowell,									
E. N. Gurley,									
G. H. Lamphier,	Nahant,	8	12	900 00	344	356 50	15,234	3,030 22	136
W. A. Smith,									
Charles Taylor,									
Chester H. Waite,									
George L. Hatch,									
Henry E. Hatch,									
Frank Leman,									
Samuel McDonald,	Nantasket,	7	9	1,070 00	370	505 00	23,574	4,831 82	90
Ephraim Onderkirk,									
Simon Rogers,									
Leland S. Topham,									
C. H. Blount,									
J. H. Dennis,									
William H. Hamblin,									
O. C. Norcross,	Nantucket,	7	8	1,227 00	219	236 75	3,340	939 32	378
Joseph H. Ray,									
Manuel Thomas,									
John S. Watkins,									
Thomas B. Dowling,									
Bartholomew Silva,	New Bedford,	4	4	1,335 00	225	312 50	14,853	1,971 82	191
Joseph C. Allen,	North Tisbury,	2	3	337 00	75	75 00	4,055	516 60	27
Walter C. Vincent,									
Daniel B. Gould,									
Caleb Hayden,	Orleans,	4	4	738 00	133	155 00	1,806	854 00	35
M. M. Pierce,									
H. C. Goodspeed,	Onset,	2	3	1,020 00	75	35 00	1,577	355 18	10
William Thompson,									
George Atwell,									
J. H. Bagnall,									
C. A. Briggs,									
H. J. Caswell,									
Charles H. Davis,									
D. J. Graffam,	Plymouth,	12	23	2,180 00	648	1,132 00	37,409	5,270 50	188
John R. Harlow,									
B. F. Hodges,									
Frank Simmons,									
Joseph P. Thurston,									

Returns from the Lobster Fisheries — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Martin Nelson, Joseph G. Perry. John W. Savage, C. H. Emery,	Provincetown,	4	5	$521 00	256	$247 00	2,927	$1,038 42	165
Manuel Marshall, Antone Vera,	Robinson's Hole,	2	5	345 00	210	188 00	5,011	624 94	80
C. F. Green, John F. Lawson, A. Rich, Ernest M. Rich, G. E. Wendell, John Bowman, Martin Bowman, Arthur Norwood, William E. Norwood, S. D. Thurston, Jr., Charles Upham,	Rockport,	12	14	1,255 00	790	1,088 00	45,556	5,507 91	211
Arthur Gibbs,	Sagamore,	1	1	25 00	75	50 00	1,247	258 99	36
Charles S. Brown, John A. Dunn, Charles L. Wales,	Salem,	4	4	675 00	290	290 00	23,379	3,524 49	183
John Elvander, John F Mahoney,	Sandwich,	2	3	254 00	47	77 00	2,369	398 50	30
Oscar Anderson, J. Frank Cushman, Charles DeCoste, George F. Edson, Charles A. Foster, Elijah P. Pratt, Thomas Turner, Daniel Ward,	Scituate,	8	13	1,715 00	600	1,105 00	37,796	5,538 59	139
William A. Blanchard, James H. Butts, Benjamin T. Smith,	South Dartmouth,	4	4	1,615 00	165	175 00	4,160	512 39	118

George W. Manter, J. A. Mayhew & Co., James F. Luce,	Tisbury,	1	1	20 00	36	46 00	1,759	165 70	6
William L. Pease, Edward H. Smith, L. E. Smith, James R. Tilton, J. W. West, George E. Whitney,	Vineyard Haven,	6	8	615 00	145	206 25	3,075	567 60	30
George A. Gifford, William A. Hammond, William S. Head, Fred W. Palmer, Harry G. Sowle, Charles Valentine, William B. Whalen,	Westport Point,	9	10	2,585 00	404	538 50	20,541	3,083 07	307
Lester D. Mayhew, Lindley W. Mayhew, George A. Rogers,	West Tisbury,	3	6	990 00	186	320 00	19,742	2,557 87	15
Francis J. Cain,	Weymouth,	2	1	250 00	150	200 00	10,196	2,476 67	61
Hartley L. Wells,	Winthrop,	1	2	250 00	50	75 00	2,677	535 40	–
L. L. Adams, James F. Cook, Charles R. Grinnell, Oscar R. Hilton, Thomas Hinckley, Alfred Nickerson, Walter E. Nickerson, Prince M. Stuart, A. H. Vedeler, John J. Veeder,	Woods Hole,	12	19	5,423 00	315	402 50	18,452	2,510 32	306
Shirley D. Lovell,	Yarmouthport,	1	1	250 00	50	50 00	903	225 00	53
Totals for State,		349	503	$70,973 50	19,294	$26,603 90	1,035,123	$154,130 74	9,081

Public Document No. 25

REPORT

OF THE

Mass.

COMMISSIONERS

ON

FISHERIES AND GAME

FOR THE

YEAR ENDING DECEMBER 31, 1909.

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The Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-fourth annual report.

General Considerations.

It is no longer necessary to discuss the fact that the fisheries, the game and the insectivorous birds are worthy of every effort not alone for their conservation, but for their extension as well. Similarly, the unwise introduction and the still more deplorable extinction of various useful species is a matter of grave moment from the biological aspect in its widest and in its most intimate complications. Even the State of Massachusetts has not been above criticism in this policy of depletion. The most important factor of this depletion doubtless has been public ownership of fish, game and birds. This necessarily tends to a *laissez faire* doctrine, and to the widespread belief that the most rapid possible private appropriation of such public property is a criterion of business ability and shrewdness. There has been a noticeable lack of biological knowledge in the general attitude of the people and in the policies of the various legislatures. In spite of all the laws both for protection and for the exploiting and maintenance of such public property, the destruction has been general and lamentable. Even under our restrictive laws the wild pigeon and the wild turkey have been exterminated within the State; the heath hen, woodcock, wood duck, upland plover, piping plover and other birds naturally breeding here are on the very verge of local extinction. The natural supply of ruffed grouse, quail and woodcock has shown alarming depreciation, largely due to the destruction of breeding grounds, and owing to the introduction of species which have brought infectious diseases; in part, perhaps, to develop-

ment of more deadly methods of hunting, both by the employment of improved firearms and more skilfully trained dogs; but above all these to the feral cat, which is increasingly infesting the covers. The decimation of these birds has made it possible for various species of destructive insects to secure a foothold. Further, the introduction of the English sparrow has, in addition to the destruction of the small insectivorous birds, laid a heavy tax upon owners of grain fields, barns and poultry yards. So, if the commissioners were asked what line of work within the province of their activities requires the most urgent attention, the answer would doubtless be that the birds at the present time require most careful consideration: through (1) a study of the diseases and the extent to which these diseases are transmitted by various species of birds to other species, and what remedies may be applied; (2) development and application of the most approved methods for increasing the bird population per square mile, in order that the birds may co-operate as an effective check to prevent the increase of insect enemies to cultivated crops, to shade trees and to all other types of vegetation. These methods would doubtless take the line of a greater number of "bird sanctuaries," *i.e.,* places from which the general public is excluded, where special preparations are made for furnishing food and suitable nesting places to useful birds of all types. In addition to this, some restrictive legislation is necessary, but the time has passed when restrictive legislation alone can meet the full measure of the situation. Some positive methods must be developed for increasing the number of our native birds. Every encouragement should be given to intelligent efforts looking towards the breeding of various species, with a provision for the greatest possible number and diversity of sanctuaries. Increased attention should be paid to preventing the damage done by those greatest enemies of the wild game and song birds, — the domestic cat, and the dog which is allowed habitually to run at large in the woods. Along with these there should be a more efficient enforcement of the constantly multiplying laws. The people must be educated towards a wider and more accurate knowledge of the natural laws which govern the species of birds and mammals.

Investigations by competently trained persons must be undertaken for the purpose of securing a definite basis of fact for legislation. Thus we may hope ultimately to reduce the excessive amount of inconsequential demands for legislation.

Finally, all the territorial resources of the State must be fully utilized for the purpose of furnishing food and business opportunities for Massachusetts people. The most conspicuous among these is the area between high and low water mark, which at present is practically unutilized. Under certain restrictions oysters and quahaugs may be cultivated by individuals. This opportunity should be extended so as to include also the soft clam (*Mya arenaria*).

The law passed by the last Legislature, prohibiting spring shooting (chapter 421, Acts of 1909), is expected to increase the number of birds breeding within the State, and ultimately to result in a large number of ducks breeding in all sections of the Commonwealth, with improvement of the duck shooting in the middle and western section of the State, instead of being practically restricted to a thin line of migrants passing only through the eastern counties.

Expenditures. — The details of all expenditures are published in the annual report of the Auditor of the Commonwealth. In general, $4,958.99 was expended for the benefit of the sea and shore fisheries; $6,950.49 for maintenance of inland resources by the purchase and propagation of trout, quail, grouse and pheasants; $32,971.63 for the enforcement of the fish, game and bird laws on land and sea; $4,420.90 for the protection of adult female lobsters by purchase of those caught when carrying eggs; $11,421.25 for the salaries for the commissioners, printing, postage, travelling expenses of the commissioners and for clerical and office expenses. The total amount of fines was $5,804.50; and of all other additional moneys received and turned into the treasury of the Commonwealth, $1,799.24.

For the reason that several of our recommendations were referred last year to the next General Court, we repeat the statements made in our forty-third annual report relative to the mollusk fisheries, to the inland fisheries, to the game birds and to deer: —

Mollusk Fisheries. — In 1905 the Legislature ordered a biological survey of the coastal areas below high-water mark, in order to ascertain: —

(1) The present and past conditions of the mollusk fisheries.

(2) The possibilities of increasing the annual production by (*a*) increasing the annual yield per acre; (*b*) suitable methods of securing an annual yield from areas at present unproductive.

(3) Ascertaining definite methods of increasing production by study of: —

(*a*) Life histories of the economic mollusks, particularly the oyster, clam, quahaug and scallop.

(*b*) Methods of feeding and rate of growth.

(*c*) Effects of unfavorable conditions; *e.g.*, pollution.

(*d*) Methods of checking ravages of enemies; *e.g.*, starfish, "drills," "winkles," etc.

A report to the Legislature upon this work states, in general, that of upwards of 60,000 acres of shellfish ground only about 3,552 acres are to-day yielding anything approximating the natural yield, *i.e.*, from \$100 to \$800 profit per annum; while upwards of 40,000 acres are producing at least 90 per cent less than normal production; and about 15,000 acres at present unsuitable could at an expense of \$50 to \$300 per acre be made to yield from \$100 to \$500 profit annually. Under such development and utilization employment would be furnished to about 20,000 skilled and unskilled laborers, as compared with 2,184 in 1907; and a total production valued in the hands of the producers at \$6,000,000 annually, instead of \$752,000 as in 1907.

The results from more than 300 experimental plots prove conclusively that clams (*Mya arenaria*) and quahaugs (*Venus mercenaria*) can by appropriate methods be as successfully cultivated as are oysters to-day, or as any farm crop; that the value of a quahaug crop upon arrival at a marketable size often exceeds \$1,800 per acre; and that the annual profit should average not less than \$200 per acre.

These fisheries are prosecuted upon what is now in the east the last remnant of the public domain, viz., between high and low tide marks. The titles to the uplands have been acquired by individuals, and are subject to individual control and responsibility; and the title of the riparian owner extends to mean low-water mark, or to 100 rods beyond the mean high-water mark in cases where more than 100 rods of tidal flats are exposed by the average tide, but the riparian owner does not have an exclusive control of the fishing, fowling and boating. He may participate in these only on equal terms with the public, and subject to the disposing right of the General Court. Similarly, State laws have been enacted by which areas below high-water mark may be leased for oyster cultivation, but the lease holder can claim as his property only the oysters grown thereon. Curiously enough, present laws permit the cultivation of oysters in the waters below low-tide mark, but not

clams or scallops, either below or above low-water mark. It would be quite as logical for the State to permit the farmer to grow only corn.

The fisheries (which include the mollusk fisheries) are still public, and subject to the disposing action of the Legislature. If the Legislature should by appropriate laws make possible intensive cultivation of shellfish, *e.g.*, the oyster, clam, quahaug, scallop and lobster, in the area below high-water mark, under proper safeguards devised to secure public and private rights, there would follow: —

(1) Increased opportunities for skilled and unskilled labor.

(2) Increased yield per acre above the natural productiveness.

(3) Increased daily profits in proportion to the time and labor of the fishermen.

(4) Increased definiteness of supply, thus permitting the fishermen to take advantage of market conditions.

(5) Increased income to town from taxable property on the shellfish beds.

(6) Increased subsidiary industries.

(7) Increased revenue to citizens, communities and State, from leases of public domain.

An extended discussion is to be found in a special report to the General Court upon the mollusk fisheries of Massachusetts.

Inland Fisheries. — As a result of drought, directly traceable in very considerable measure to unwise methods of deforestation of our hills, many of the smaller brooks and the upper reaches of larger brooks, which are the nurseries of brook trout, have been entirely depopulated. In addition, we again repeat the statements given in the previous reports, that we should not be longer compelled to maintain unwise, inadequate and unbusiness-like methods of stocking public waters. We respectfully urge consideration of an improved system of stocking, whereby certain well-known and suitable waters, definitely designated as public waters under the control of the Commonwealth, and adequately protected and stocked, are maintained at their highest productive capacity.

Our present system of propagating, rearing and distributing fish is antiquated, and, while entirely adequate to meet the conditions under which it was developed, was not planned with a view to future extension of facilities, and has become entirely incapable of meeting the present demands. Greater results can be obtained from one model hatchery, having a sufficient water supply to maintain a stock of selected brood fish, and with hatching house, trays and rearing pools sufficient to turn out annually 5,000,000 fry, at least 500,000 fingerling trout, and at least 1,000,000 white perch.

Many inquiries have been made relative to the State hatcheries, which were established by special acts of the Legislature, as follows: resolve 114, Acts of 1896, appropriating $3,000 for the establishment of a hatchery at Hadley; resolve 74, Acts of 1897, appropriating $3,000 for

the establishment of a hatchery at Winchester; resolve 60, Acts of 1898, appropriating $2,500 for the establishment of a hatchery at Adams.

From 1880 to 1894 inclusive trout fry to a number of not less than 43,000 or more than 600,000 in any one year, and an average of 316,000 annually, were received from the hatchery at Plymouth, N. H., the cost of maintenance of which the State of Massachusetts shared equally with New Hampshire. Since the establishment of the hatcheries at Winchester, Hadley and Adams the annual output from each has averaged about 200,000 trout fry. At the time of the establishment of those hatcheries there were practically no commercial hatcheries in the State, and the price at which the fish could be bought was at least five times that at which they may be bought at present. The total cost of maintaining the three small hatcheries for the rearing of fry only is less than $1,100 annually. The average aggregate output for the three hatcheries is about 600,000 fry, which at $1.50 per thousand would make the total yield valued at $900. The cost of distribution from these three hatcheries, situated respectively in the eastern, the middle western and western part of the State, is very much less than if the entire distribution were made from the eastern part of the State, as might be necessary if the fish were purchased; so that, in our opinion, there is practically no difference in the cost of buying the fish and the cost of hatching by the State.

We are informed by the Massachusetts Bureau of Statistics of Labor that wild trout are taken in this State to the value of $66,000 per annum, at a total cost to the Commonwealth of about $5,000 in the maintenance of the above three hatcheries and of the Sutton hatchery, which latter annually produces about 200,000 fry and from 70,000 to 155,000 fingerlings, or a total for the State of 800,000 to 900,000 fry and 70,000 to 115,000 fingerlings.

The chief difficulties in the maintenance of fish in Massachusetts waters are connected with the excessive pollution of the larger streams and the deforestation of the mountain slopes, resulting in the drying up of the nursery brooks. There is absolutely no question that a larger plant of cultivated fish would be more economical to the State, and is beyond question necessary in order to secure proper results.

In reference to the abandonment of the hatcheries at Winchester, Adams and Hadley, the commissioners are of the opinion that it is not expedient at present to discontinue these hatcheries, for the reasons stated above; and we are further of the opinion that we would have no right to abandon them until ordered to do so by legislative act.

On account of the need of extensive repairs to the water supply, we have thought it unwise this year to attempt to use the Winchester hatchery until the general policy has been definitely settled.

Game Birds. — In the pioneering work of devising methods of rearing game birds in captivity much progress has been made. The area available for rearing the birds has been so circumscribed and so subject to infectious diseases, from long occupation, that many untoward losses have been experienced which would not have occurred in a location suitable for breeding quail and ruffed grouse, where the ground and air were uncontaminated by disease germs from domestic poultry and the birds safe from the abandoned cat. A movement to establish "sanctuaries," wherein native birds may breed in safety, is under way. The State reservations should be multiplied and utilized, particularly for breeding and feeding refuges for native birds.

There is a mistaken opinion abroad that the State reservations are in themselves sufficient sanctuaries for breeding and feeding refuges for birds. Nothing could be farther from the truth, for the reason that from their very size they are difficult to control, not alone in respect to human poachers, but also against the numerous enemies of nesting birds; and especially from the fact that it is well known that birds, particularly game birds, are not likely to resort to and breed in places which are freely open to the public, and which are daily visited by hundreds and even thousands of people.

We again express the opinion that the breeding of pheasants perhaps may ultimately be safely left to private individuals.

Deer. — While it is certainly a fact that the wild lands of the State are well adapted for producing an annual crop of wild deer, an undue increase will without doubt entail hardship upon farmers and property owners. Every possible safeguard should be adopted to protect property and the rights of property owners. In the near future it may be necessary to control the increase of deer. A general open season, even for a very few days, would bring out an indiscriminate rush of inexperienced and irresponsible hunters. To prevent untoward results it may be necessary to issue a special license for deer hunting, with a fee sufficient to limit it to persons of responsibility, and to ensure to the State reimbursement for moneys paid to land owners for damage to crops by deer.

Marine Fisheries.

The dominant tone of the industry is that of a return to the normal, — an average catch, a living wage for the fishermen, a fair profit for the vessel owners and distributor, and improved quality and service for the public. All of this reacted to furnish employment to an increased number of workers in the allied in-

dustries, so that on the whole the year has been a reasonably prosperous one to Massachusetts' fundamental industry.

There are those who ascribe to the visit to Massachusetts of the delegates to the International Fisheries Congress, in 1908, a stimulus to co-operation and augmented activity on the part of fishermen, dealers and manufacturers, which has resulted in convincing the best minds in the fisheries of Gloucester, Boston, Cape Cod, and, indeed, the entire shore, that the fishing interests of Massachusetts are State-wide, rather than local; that sectional jealousies should be eliminated; and that broad-gauge methods of legitimate, keen and generous business competition should displace invidious, narrow business methods, and, by the stimulus of active, scientific constructive competition, maintain unrivalled the reputation of Massachusetts fish and fisheries products in the markets of the world. During the past season a special advance was made in a method of getting the fish to the curers in better condition, which has shown marked results; the shack fishermen have successfully inaugurated the practice of salting the catch of the first baiting and bringing in fresh the catch from the second baiting.

The total receipt of fresh fish at Boston was nearly 2,000,000 pounds greater than in 1908.

YEAR.	Haddock.	Cod.	Hake.	Cusk.	Pollock.	Halibut.	Totals.
1909, . .	38,485,250	25,840,700	11,469,400	1,962,700	7,968,850	1,204,950	86,931,850
1908, . .	37,581,600	27,502,000	11,365,800	1,668,100	6,617,400	300,550	85,036,450

The fleet numbered 291 sailing vessels, 1 steam otter trawler ("Spray"), 2 gasolene steamers and 150 boats of various kinds, — a total of 444.

Great consideration on the part of the State is due to fishermen and dealers who, under the exceedingly unfavorable conditions which have long obtained at T wharf, have developed here the second largest fresh-fish mart in the world (exceeded only by Grimsby, Eng.), by sheer force of business capacity, ability for persistent hard work, and a determination to furnish for the consuming public a cheap and wholesome food supply in the best sanitary condition possible under existing circumstances. It is

certainly to be expected that the State should recognize the immense value of the fisheries trade to Boston and to Massachusetts, and by providing a suitable location upon the Commonwealth flats, remove the handicap under which the fishermen and dealers have long been working, and speedily permit an extension of the business, that a still more rapid growth may ensue from which the public will derive immediate benefits. The State should see to it that our "original industry" should be fostered, and should recognize that it deserves adequate quarters equal or better than the Commonwealth dock at South Boston.

The Gloucester Fisheries. — Many vessels in the various branches of the fisheries made remarkable stocks. Records of many years' standing were excelled by some craft, while others established new marks in certain special lines. The fishermen, the skippers and vessel owners participated in the general prosperity which came to the sea toilers of Gloucester.

The leader of the record-breakers was the schooner "Arkona," Capt. Newman Wharton, which established a new high-water mark for a season's stock and for the amount of fish landed in one season in the salt bank cod fishery. This craft made three trips, one trawling and two dory handlining, landing the enormous amount of 835,470 pounds of salt cod, and stocking, on the three trips, $24,949.28. The crew's share was $546.50 per man.

Another record breaker was the dory handline trip of the schooner "Tattler," Capt. Alden Geel. This craft made a late summer trip, fishing on Quero bank, and as autumn came continued on to the grounds at the Virgin Rocks, coming home with nearly all the fish the big craft could carry. The fare weighed off 479,433 pounds, — the largest salt cod fare ever landed at this port, also the largest ever recorded on the Atlantic coast by a two-masted schooner. On the big catch the fine stock of $15,277.31 was made, the high line of the crew taking $342.93 for his share, while the average share was $263. Captain Geel has held many records in the salt fishing line, and this is another one to his credit.

Another record was made by the schooner "Onato," Capt. J. Henry Larkin. This craft, during the spring and summer, was engaged in cod shacking on Quero bank, and one of her

fares exceeded all previous records in this branch of the fisheries, both for amount of fish brought home and for stock and share. The vessel weighed off 139,800 pounds of fresh cod, 113,000 pounds of salt cod, stocking $5,550, the crew sharing $138 clear.

During 1909 among the other noteworthy performances in the big trip and stock line were the following: —

Schooner "Aloha," Capt. John McInnis, on a dory handline salt cod fishing trip to the Virgin Rocks, weighed off 356,000 pounds of salt cod, stocking $11,084.39, the high line of the crew sharing $288.38. Twelve of the crew on the trip made over $200 each.

Schooner "John Hays Hammond" had a big year in command of Capt. Lemuel E. Spinney, her owner. She made seven fresh halibut trips, his stock being $21,473.82, thus averaging over $3,000 for each trip. During the balance of the year the craft went haddocking under command of Capt. Horace Wildes, who also did well in her. Her year's stock reached the fine total of $30,352.64.

One of the most brilliant performances of the year was that of Capt. James D. Goodwin. On Nov. 1, 1908, he took command of the big gasolene auxiliary knockabout "Benjamin A. Smith," and engaged in the winter haddock fishery until spring, when he fitted out his own schooner, "Ella M. Goodwin," for a salt bank trawl cod fishing trip, following this up with a dory handline trip in the same vessel, and ending his year Sept. 12, 1909, thus having been in commission a little less than ten and one-half months. In that time he stocked $34,925.85. The haddock season gave him a stock of $15,925.85, while the remaining $19,000 was the stock of the trawl and dory handline bank cod fishing trips.

Another big year's work was that of Capt. Clayton Morrissey, in the big knockabout schooner "Arethusa." He made two salt trawl bank cod fishing trips, weighing off 770,040 pounds of salt cod, stocking $21,063.65. The crew's share was $410.12 per man.

Schooner "Maxine Elliott," Capt. Thomas Benham, made three dory handline cod fishing trips during the season, landing

700,200 pounds of salt cod, making the fine stock of $21,200, the high line of the crew taking down $537, while the average share was about $415.

Schooner "J. J. Flaherty," Capt. Fred LeBlanc, made two dory handline cod fishing trips to the banks during the season, and brought home 682,000 pounds of salt cod. On this a stock of $20,808.19 was made, the high line share being $516 and the average share $377.

Schooner "Hazel R. Hines," Capt. Fred Morrissey, of the salt trawl bank fleet, made two trips, weighing off 597,206 pounds of salt cod, stocking $16,215.43. The sharesmen profited to the extent of $527.18 each.

Our fishermen are ever alert for new methods and for information which enables them to "follow the fish" more closely. The deck handline salt cod fishing fleet could in previous years generally be divided into three sections, drifters or "Rippers," "Georges" and "Eastern." But last season almost the entire fleet fished to the eastward, on Quero and Western banks; and, as almost all combined both deck and dory handlining, it is therefore hard to draw any distinguishing lines. A few of the regular "Rip" or drift fleet stuck to straight deck drifting, and some of the old Georgesmen did the same; but the great majority went after the codfish to the eastward, and got them any way they could catch them, from deck drifting or at anchor, or with double dories. In this "combined" branch of the fisheries some fine fares were secured.

Schooner "Hattie A. Heckman," Capt. Israel Bellevue, one of the eastern deck handline anchor fleet, with double dories, weighed off as the result of one trip 122,000 pounds of salt cod, making the big stock of $4,002.10, the high line of the crew taking down $142.56. Several others of the crew also made over $100.

Schooner "Gladiator," Capt. Nelson Thorburn, going the same as did the "Hattie A. Heckman," weighed off on one trip 123,000 pounds of salt cod, stocking the fine amount of $3,763.50, while the high liner of the crew made $110.17.

Schooner "Mina Swim," Capt. William Forbes, one of the Rips or drift fleet, fishing to the eastward and carrying double

dories, weighed off, as the result of one trip, 122,000 pounds of salt cod, stocking $3,761.23, the high line of the crew making $153.37.

Similarly, the schooner "Eugenia," Capt. John Williams, made two of these big trips, weighing off 106,000 pounds of salt cod on one and 112,000 pounds on the other. On the latter trip the stock of $3,295 was made, the high line getting $137 and 15 out of the 18 men of the crew receiving $100 or more each.

Schooner "Gertrude," Capt. James Vanamberg, fitted like the "Swim" and "Eugenia," weighed off 106,000 pounds of salt cod on one trip, the stock being $3,200; while the schooner "E. C. Hussey," Capt. Clifford Hopkins, fitted likewise, weighed off 100,554 pounds of salt cod on one trip, stocking $3,082.

The Mackerel Seining Fleet. — The mackerel seining fleet, as a whole, had a poor season last year; but in spite of this, several vessels made a good year's work.

Schooner "Mary E. Harty," Capt. Reuben Cameron, was high line of the fleet, with the fine stock of $22,200. Beside carrying off the high line honor, Captain Cameron placed a record to his credit by landing the most remunerative trip in the history of the southern mackerel fishing season. He struck the fish off the back side of Long Island, and ran to market at Newport, R. I. The fare counted out 48,808 mackerel, and the stock was $6,571, — the record for a single "out south" mackerel trip.

Among the others who made good stocks in the mackerel seining fishery were the following: —

Schooner "Pontiac," Capt. Enos Nickerson, $16,700.

Schooner "Priscilla Smith," Capt. William J. Corkum, $13,000.

Schooner "Constellation," Capt. Thaddeus Morgan, $12,600.

Schooner "Victor," Capt. John W. McFarland, $12,200.

Schooner "Benjamin A. Smith," Capt. Solomon Jacobs, $12,200.

Schooner "Oriole," Capt. Charles H. Harty, $11,400.

Schooner "Effie M. Prior," Capt. Elroy Prior, $11,300.

Schooner "Judique," Capt. Gourley Anderson, $11,000.

Halibut Fleet. — The so-called "Georges" halibuters had a

fine season almost without exception, and a number of them did remarkably well. The high liner of the fleet was the schooner "Dictator," Capt. Fred Thompson, and this craft was also the leader of all the fresh halibut vessels for the year 1909. The stock was $26,312.98 and the crew's share $635.22 per man.

Other highly satisfactory stocks were also made: —

Schooner "Teaser," Capt. Peter Dunsky, stock $24,922.87 and share $651.68.

Schooner "Kineo," Capt. John G. Stream, stock $22,904.66, the crew sharing $617.98.

Schooner "Selma," Capt. Charles Colson, stock $22,489.18, the crew sharing $611.36.

Some of the crafts in this Georges halibuting fleet, mentioned above, made their stocks in from nine and one-half to eleven months.

Of the straight halibuters, the schooner "Mooween," Capt. Daniel McDonald, made a phenomenal record. From Nov. 20, 1908, to Dec. 20, 1909, the craft made the splendid stock of $28,600, the crew sharing just $700. The loss of six of his crew in a terrible squall last spring so affected Captain McDonald that he stayed ashore for a while, and late this fall decided to haul up until the beginning of the year, when he fitted out again and made another trip. But for these occurrences the chances are that the season's work of the craft would have been very remarkable. On one trip Captain McDonald stocked $5,289, the crew sharing $138.20, — the largest stock and share on a halibut trip for many seasons.

Some of the vessels of the flitched halibut fleet did finely last season.

Schooner "Oregon," Capt. Albert Flygore, was high line, weighing off 135,000 pounds of flitches, stocking $10,783.27, the crew sharing $274.48.

Schooner "Admiral Dewey," Capt. James Hayes, weighed off 122,948 pounds of flitches, stocking $10,195, the crew sharing $258.14.

Schooner "Fannie A. Smith," Capt. Joseph V. Bonia, stocked $9,220 on her flitching trip, the crew sharing $221.48.

The Pacific halibut fishery owes much to Massachusetts brains, enterprise and capital.

For the first time in the history of the halibut fisheries of the British Columbia coast fish have been taken on banks in the ocean to the west of Graham Island, the most northerly of the Queen Charlotte Islands.

These banks, lying from two to eight miles off the coast, were discovered recently by Captain Rorvick of the Canadian fishing steamer "Celestial Empire," owned by the New England Fishing Company, according to the statement of a member of the ship's crew. On this virgin ground the "Celestial Empire" made a catch of 140,000 pounds of fish in three days. In one instance 900 fish were caught by three dories at one set of gear. The fish are declared to have been all large, averaging in the vicinity of 250 pounds apiece. ("Fishing Gazette," Jan. 15, 1910.)

Schooners "Francis P. Mesquita," "Maud F. Silva," "Mary DeCosta," "Edith Silveira" and "Belbina P. Domingoes" and others of the market fleet from this port have made a big year's work. The crew of the "Frances P. Mesquita," Capt. Joseph P. Mesquita, from November 1 to November 16, just fifteen days, shared $117.50 per man; while the schooner "Maud F. Silva," Capt. John Silva, stocked $7,000 from August 7 to September 29, — big work for fifty-three days. The "Mary E. Cooney" and the "Maud F. Silva" each stocked $1,700 in one week last fall; and the crew of the schooner "Edith Silveira," Capt. King Silveira, shared $124 in two weeks. Several of these boats made crew shares of over $70 in one week.

The high line of the shack and haddock fleet from Gloucester in 1909 was the schooner "Thomas S. Gorton," Capt. William H. Thomas, with a stock of $36,000. Captain Thomas always makes a big year's work, and is one of the biggest fishermen on the Atlantic coast, being exceeded only by the schooner "Mary C. Santos," Capt. Manuel C. Santos of Provincetown, stocking $39,900.

Schooner "Raymah," Capt. Felix Hogan, stocked $24,632.85 last year in the haddock and shack fisheries, the crew sharing $550.

Schooner "James W. Parker," Capt. George Tufts, was another vessel which did well haddocking and shacking, stocking $22,840.10 for 1909.

Swordfish. — The swordfishing fleet consisted of 66 vessels, nearly all having gasolene motors.

Schooner "Rose Standish," Capt. James O'Neil, was high line of the swordfish fleet, with a stock of $7,333.33 and a crew share of $425.90.

Schooner "Valentinna," Capt. Charles O'Neil, stocked $6,200, the crew sharing $360.

The cod shack fishing last summer was very profitable to the vessels engaged. The fleet fished on Quero bank, and most of them made three and four trips. Schooner "Thomas S. Gorton," Capt. Wm. H. Thomas, stocked nearly $15,000 on four trips, the crew sharing $316.93. Schooner "Onato," Capt. J. Henry Larkin, got about $14,000 on her three big fares. Many of the fleet made trips which netted over $100 shares to the men of the crews.

Schooner "Corona," Capt. Horace Wildes, in this fishery weighed off 170,000 pounds of salt cod on one trip, stocking $4,555, the crew sharing $114 clear.

Schooner "Susan and Mary," Capt. Albert Hubbard, had two big salt shack fares in succession, weighing off the big total of 306,000 pounds of salt cod as the result of the two trips.

Details of the catch of the Gloucester fleet follow. Although there was a decrease in the total catch, the increased price obtained more than covered the deficiency to the fishermen.

Fish.	1909.		1908.		1907.	
	Barrels.	Pounds.	Barrels.	Pounds.	Barrels.	Pounds.
Salt cod,	-	33,107,085	-	23,115,705	-	15,712,700
Fresh cod,	-	12,299,259	-	13,130,700	-	16,167,400
Halibut,	-	2,368,582	-	2,816,050	-	3,081,765
Haddock,	-	4,402,100	-	8,409,100	-	6,063,800
Hake,	-	1,805,590	-	7,868,400	-	9,801,950
Cusk,	-	1,362,960	-	3,405,800	-	4,805,300
Pollock,	-	5,901,125	-	7,133,200	-	16,754,400
Flitched halibut,	-	800,109	-	880,542	-	826,210
Fresh mackerel,	3,348	669,600	4,365	873,000	3,067	613,400
Salt mackerel,	14,805	2,961,000	17,450	3,490,000	29,725	5,945,000
Fresh herring,	5,288	1,057,600	20,537	4,107,400	13,091	2,618,200
Salt herring,	46,420	10,583,760	36,737	8,376,036	71,561	16,315,908
Frozen herring,	17,635	4,408,750	26,450	6,612,500	21,565	4,313,000
Swordfish,	-	6,184	-	11,954	-	8,250
Cured fish,	-	4,091,100	-	3,404,800	-	2,004,800
Porgies,	817	163,400	-	-	-	-
Halibut fins,	298	59,600	358	71,600	413	82,600
Whiting,	500	100,000	4,000	800,000	16,000	3,200,000
Shad,	749	159,800	1,653	330,600	355	71,000
Fresh fish from boats,	-	300,000	-	600,000	-	750,000
Miscellaneous,	-	1,743,800	-	1,285,200	-	744,176
Total landed at Gloucester,	-	88,351,404	-	96,722,587	-	109,879,859
Total by Gloucester vessels at other ports direct (estimated),	-	36,359,800	-	32,601,850	-	39,100,000
Total at Gloucester and by Gloucester vessels at other ports,	-	124,711,204	-	129,324,437	-	148,979,859

The Lobster Fishery.

Your special attention is directed to the deplorable conditions which exist in the lobster fisheries of this State. On account of the organization of the trade in live lobsters from Nova Scotia and Maine, the real conditions are effectively masked to the public eye. The actual status, however, is evident only to those who attempt to catch lobsters in waters where they were formerly abundant. The public waters of our coasts, except in certain regions where the pollution is obvious, are as well suited for producing an annual crop as formerly. The actual catch, however, is vastly reduced, as a result of unwise legislation, whereby the reproductive capacity of the race is disastrously impaired by killing the best breeders through a long series of years. Without adequate knowledge of biological conditions, the Legislature in the early '70's was led to believe that if the lobster had a chance to breed at least once, sufficient young would be annually produced to meet the market demand. Although experience has proved the contrary, the Legislature of 1907 was hoodwinked and cajoled by the "special interests" to carry still further this mistaken manner of "protection" (?), and has made a bad matter worse by permitting the capture of any lobster above 9 inches, instead of above 10½ inches, as formerly, so that at present the only practical protection in any degree adapted for maintaining the future supply is that exceedingly small measure afforded by the prohibition of killing the egg-bearing females, the purchase of such by the State, and the liberation of the young by the United States Bureau of Fisheries.

Our lobster laws as to-day existing are capable of such facile evasion that they can be enforced only by the constant presence of an officer in the boat of every dishonest fisherman, — a condition obviously impracticable.

The disastrous effects of these laws are notoriously evident in (1) the decreased average size of lobsters taken in Massachusetts waters; (2) the diminishing number taken, even by an increased number of men and traps; (3) and the diminishing ratio of egg-bearing lobsters, — facts which are now too well known to require further proof.

The chief argument against a law which would at least tend in

a small measure to check the unwise and selfish destruction of the breeding lobsters, and thereby insure the production of a greater number of eggs, is the cry from the fishermen, that many poor and honest people would by a change in the present law be deprived of a means of livelihood; and from the trade, that their business arrangements would be inconvenienced.

However, evidence is accumulating that the public will not long permit the present destructive methods of fishing to be continued, and will demand a law which can be enforced without excessive cost to the public. As tending towards such a desirable condition, we are urgently recommending that every one who fishes for lobsters should be required to take out a license, thus making an effective enforcement of law possible by providing that all persons who are convicted of violation of the lobster laws shall be refused a license for one year from date of conviction. Such a license law would disarrange the organization at present existing, whereby there is a pooling of interests, so that the fines incurred through violations of the lobster laws are assessed pro rata among members of the combination.

Further, we recommend that the measurements be made according to the Maine method, upon the "body shell" (carapace), instead of upon the whole lobster, as the law reads at present, — "from the extremity of the bone protruding from the head to the end of the bone of the middle flipper of the tail."

The intelligent fishermen already recognize the importance of maintaining a sufficient number of adults to produce eggs, and are not misled by assertions that if a law were passed to place a perpetual close season upon the large lobsters, all the small lobsters would be caught, and none left to reach the period where they would be immune to capture; or the other, even more specious, which appeals most strongly to the merely commercial tendency, — that a 9-inch lobster at the next moult becomes a 10½ or 11 inch, worth twice as much on the market. This argument entirely ignores the biological fact, of utmost importance, that the larger lobster is worth even still more as an egg producer, and that the maintenance of the market supply depends entirely upon the large lobsters; *e.g.,* a 16-inch lobster produces 80,000 to 100,000 eggs, whereas a 9 to 11-inch lobster averages 5,000 to 10,000. But, most important, a 12-inch lobster

has practically no enemies except man, and, having passed successfully through all the innumerable vicissitudes of early life, is probably the sole survivor of at least 15,000 (very probably many thousands more) who began life together, and is practically certain to continue as a breeding individual for at least ten or twenty years longer, producing in that time an aggregate of approximately 500,000 young, or probably more. On the other hand, the 9 or 10 inch lobsters are destroyed in enormous quantities by codfish, sharks and other bottom-feeding fish; and therefore a considerable proportion of all the lobsters below 12 inches used as food by man would have been destroyed by natural enemies had man not intervened. Therefore, if man is content to use only lobsters below 12 inches, he is, as it were, only competing with other animals who use lobsters as food; whereas, if man insists upon destroying those which have escaped, viz., those above 12 inches, he is slowly but surely reducing the breeding stock, and the ultimate depletion is as certain as if he daily ate the laying pullets from his flock. In the case of the lobster, the vastness of the flock, spread over 130,000 square miles, and the fact that we therefore cannot actually, but only indirectly, and after decades or even generations, see the results of such a destructive policy, conceals the actual facts from the public. The public is after all most interested in and responsible for the maintenance of the State and national fisheries, and the people must emphatically demand consideration.

Summary of Statistics relative to Lobster Fisheries.

Year.	Men.	Traps.	Lobsters.	Average per Pot.	Egg Lobsters.	Ratio of Egg Lobsters to Total Catch.
1890, ...	479	19,544	1,612,129	82	70,907	1:22
1905, ...	287	13,829	426,471	31	9,865	1:42
1907, ...	379	21,342	1,039,886	49	10,348	1:100
1908, ...	349	19,294	1,035,123	54	9,081	1:115
1909, ...	522	29,996	1,326,219	45	11,656	1:115

The above statistics indicate the status both of the lobster catch and of the source of supply. Previous to 1890 there had

been a progressive decline, but the results became most conspicuous later, when from 1890 to 1905 the catch declined 75 per cent., and the egg-bearing lobsters dropped from 70,000 to about 10,000, or a decrease of about 84 per cent.

In 1907 the passage of the 9-inch law made legal the catching of all above 9 inches. Note that in 1907 the number of men increased over 1905 32 per cent.; the number of traps increased 54.32 per cent. The number of legal lobsters reported increased 144 per cent., but the total number of egg-bearing lobsters increased only 4.9 per cent. The price to the consumer has increased since 1890 200 to 300 per cent. The change in the law has temporarily masked the decline formerly shown by statistics. But this decline will soon again become obvious.

We predict that within five years the decreased marketable supply will become still more reduced, and that commercial extinction of the lobster in Massachusetts waters is certainly imminent, unless effective measures are immediately taken.

The Purchasing of Egg-bearing Lobsters (Acts of 1904, chapter 408). — The method of collecting egg-bearing lobsters by the launch "Egret" has proved costly and unsatisfactory. Next year an attempt will be made to furnish better service at less expense. This branch of the work has been productive of so much bad feeling among the fishermen that the wisdom of the law is frequently questioned. The total number of egg-bearing lobsters collected by the "Egret" was 2,725; by Deputy Mecarta, 1,732.

The Mollusk Fisheries.

Reference has already been made to the generally unsatisfactory condition of the mollusk fisheries. Vast areas are now unproductive, awaiting fair and intelligent legislative action.

Our investigations this year have continued upon the determination of the potential food productivity of the seashores.

A report upon the scallop fisheries is in press.

A brief report follows upon the sea clam (*Mactra*), so-called, in distinction from the soft clam (*Mya*) and the hard clam (*Venus*).

THE GROWTH AND HABITS OF THE SEA CLAM (*Mactra solidissima*).

DR. GEORGE W. FIELD, *Chairman, Massachusetts Department of Fisheries and Game, State House, Boston, Mass.*

SIR: — I herewith submit the following report upon the growth and habits of the sea clam (*Mactra solidissima*), one of the valuable bait mollusks of Massachusetts. The material was collected in connection with the mollusk investigations conducted by this department from 1905 to 1910.

Respectfully submitted,

DAVID L. BELDING, *Biologist.*

Presentation of the Report.

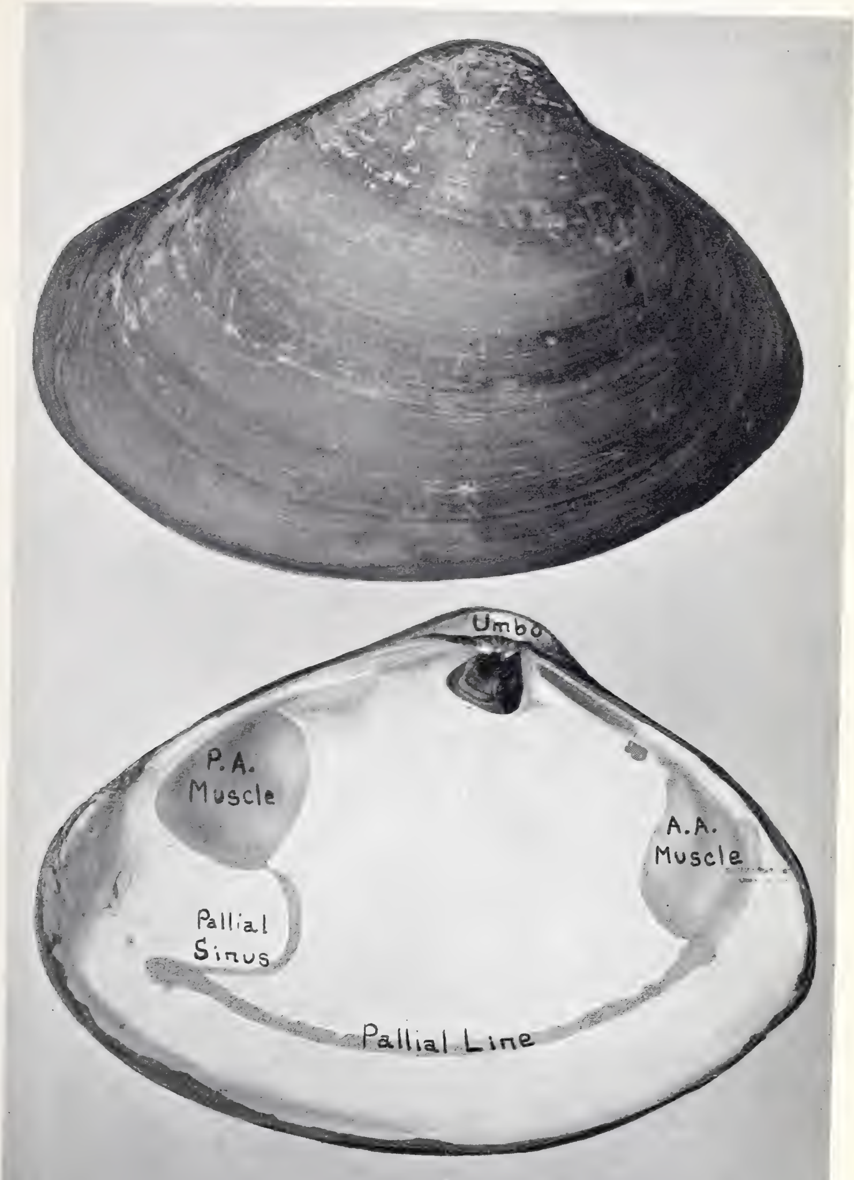
The following notes are compiled from observations made at various localities along the Massachusetts coast, principally at Monomoy Point and at Wellfleet on Cape Cod, during the years from 1905 to 1910, in connection with experimental work on other mollusks. Although no definite plan of experiments was outlined, these observations are sufficient to add to the popular knowledge of the growth and habits of this important food and bait mollusk.

The primary object of this report is to show, by a description of the life and habits of the sea clam, what means, if any, can be employed for the future conservation of the fishery. For this reason the investigation was conducted along the following lines: (1) a survey of the present distribution in the waters of the Commonwealth; (2) a study of the habits, including the method of life, enemies and spawning; (3) the rate of growth and adaptability for culture. For securing brevity, the subject matter is presented in the form of answers to such questions as are propounded by the practical fisherman.

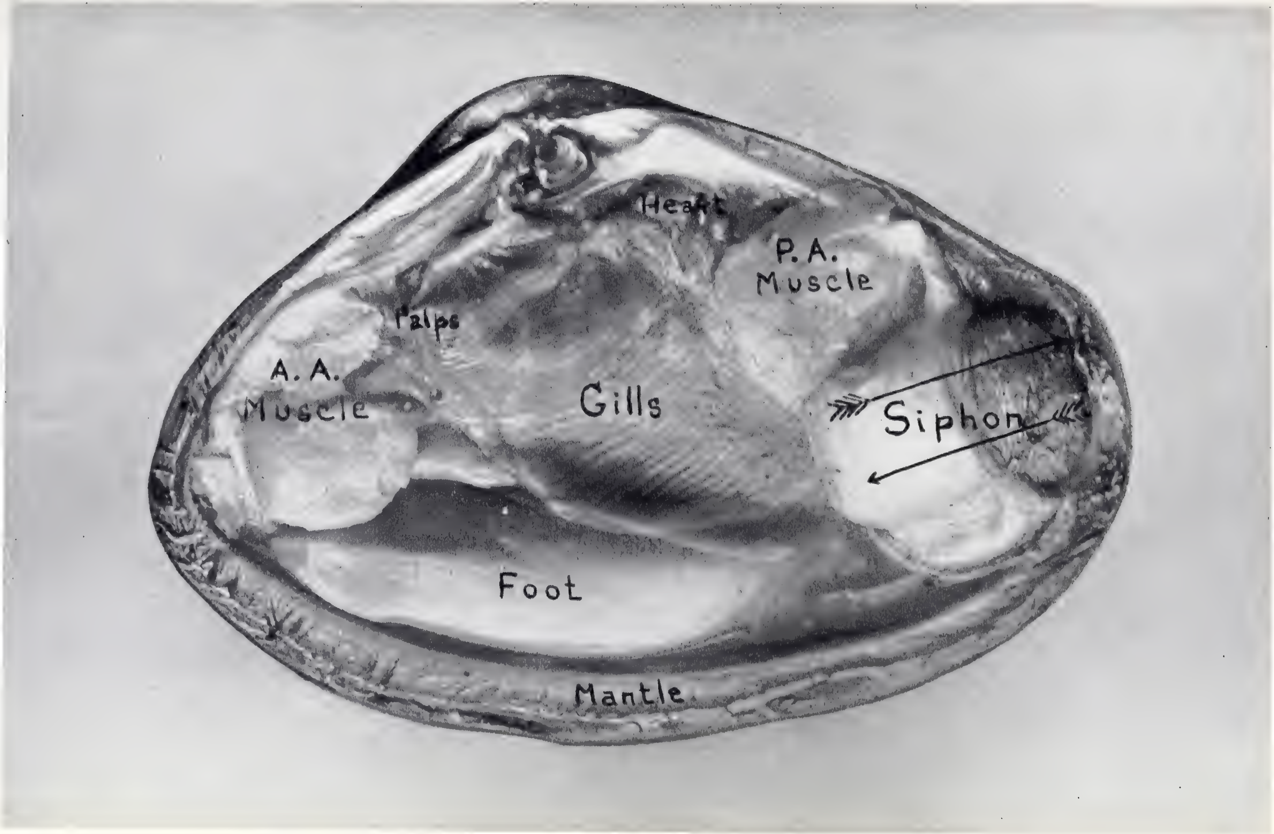
Methods of Investigation.

As the migratory habits of the sea clam rendered confinement necessary, the growth experiments were conducted in pens and boxes at Monomoy Point, Chatham, one of the few localities where sea clams are found in abundance at the present time. The actual planting was carried on in the Powder Hole, an enclosed body of water connected with the ocean by a shifting channel in the vicinity of the natural sea clam beds. The pens, usually one one-thousandth of an acre in area, were constructed of boards projecting three to four inches above the surface of the sand, in order to confine the sea clams. The pens were planted below low-water mark and between the tide lines. Also, ordinary dry goods boxes were partly filled with sand, the projecting sides making them comparable to the raised pens. Part of these boxes were placed in shallow water, two to three feet in depth, on the south side of the Powder Hole; while the remainder were suspended from a

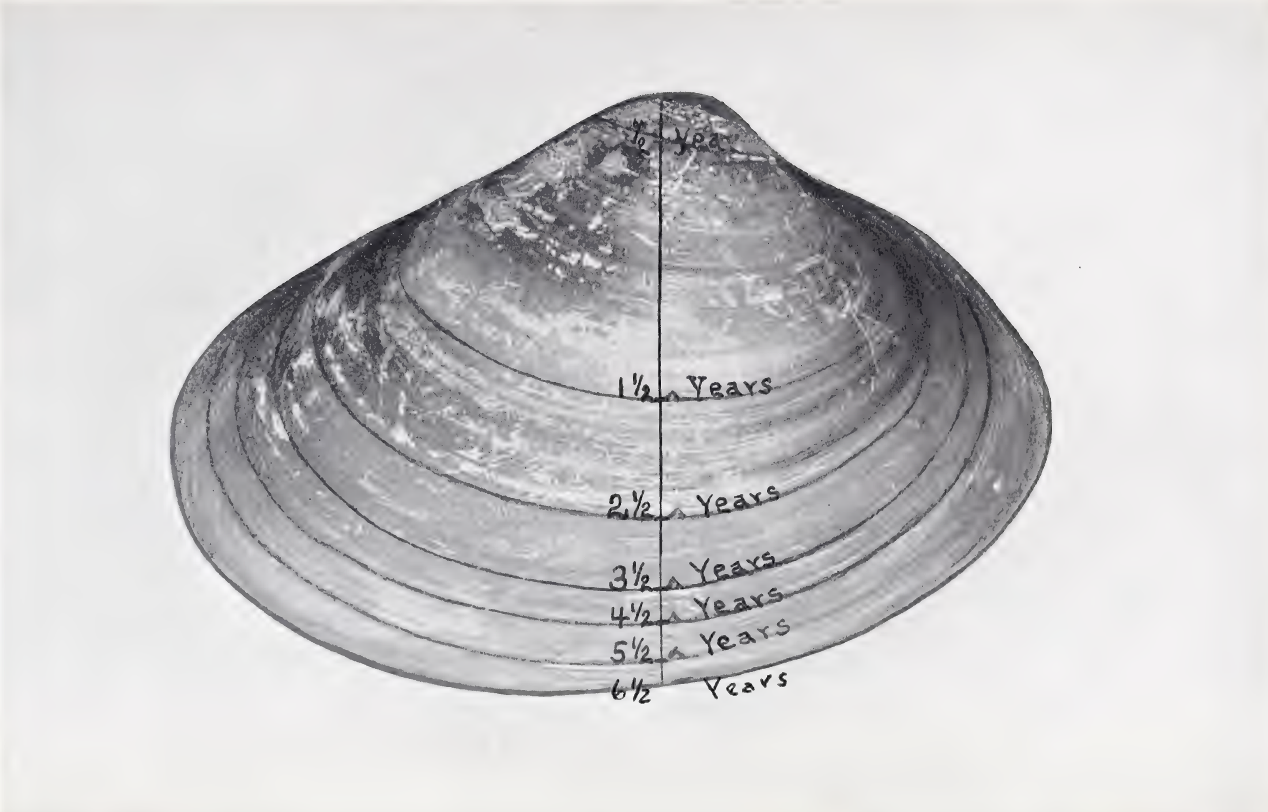
The upper figure shows an external view of the right valve of a five-year-old sea clam; the lower, the interior of the left valve. The exterior of the shell is covered by a thin yellow epidermis, except at the umbo or beak, where this "skin" is worn off. The interior of the valve shows the hinge, with the horizontal teeth and the elastic pad, the scars of the adductor muscles, and the pallial line and sinus of the mantle and siphon.


Umbo
P. A.
Muscle
A. A.
Muscle
Pallial
Sinus
Pallial Line

The internal anatomy. The left valve and mantle have been removed, leaving the siphon intact. The large muscular foot, the curtain-like gills, the adductor muscles and contracted siphon are clearly shown.


Heart
P. A.
Muscle
Palps
A. A.
Muscle
Gills
Siphon
Foot
Mantle

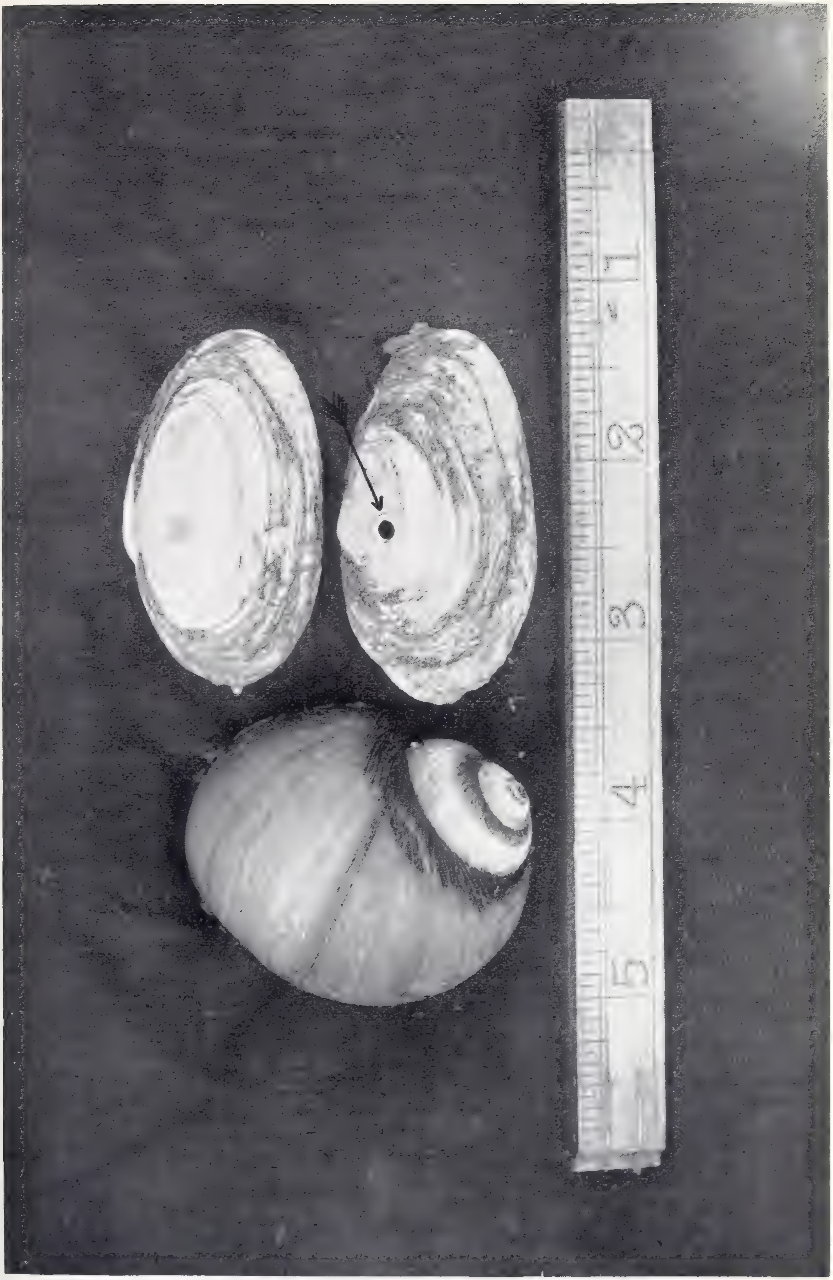
The stages of growth for the average sea clam six and one-half years old are here represented by concentric lines, which show the actual size at yearly intervals from the age of one-half year to six and one-half years. The actual lengths are: one-half year, 1 inch; one and one-half years, $1\frac{3}{5}$ inches; two and one-half years, $3\frac{1}{5}$ inches; three and one-half years, $3\frac{3}{5}$ inches; four and one-half years, 4 inches; five and one-half years, $4\frac{1}{4}$ inches; six and one-half years, $4\frac{1}{2}$ inches.


1½ Years
2½ Years
3½ Years
4½ Years
5½ Years
6½ Years

Sea clams from the raft boxes at Monomoy Point, five-eighths life size. The size when planted is shown by the growth line and notch. The increase in size has taken place in one year.

A view of the small outer harbor at Monomoy Point, showing the quantities of small sea clams which have been destroyed by the winkles (*Lunatia duplicata* and *heros*) and by washing ashore. The beach at this point was literally paved with the shells, a striking instance of the destructive powers of nature.

The winkle or cockle (*Lunatia heros*), an enemy of the quahaug, clam and sea clam, with a soft clam (*Mya*), which it has bored. The winkle attacks the sea clam by boring a similar hole through the umbo, usually slightly higher, in the case of the sea clam, than is shown in the photograph, and sucks out the contents. Notice the countersunk rim, which is characteristic of the work of the winkle. Large quantities of sea clams are annually killed by this enemy.



raft in the center of the harbor, where the best circulation was obtainable.

The main difficulty in conducting growth experiments was the inability to simulate the natural conditions under which the sea clam lives. The habitat of this mollusk is the shifting sand bars of exposed coasts. Attempts at planting in such an environment proved failures, as the sea clams all escaped, and it became necessary to conduct the growth experiments in quieter waters. The sea clam in its natural habitat receives a good circulation of water, — the essential factor in shellfish growth. Although the experimental beds were not under absolutely natural conditions, it is nevertheless reasonable to assume that the growth in beds receiving a like circulation of water should be approximately the same as on the natural flats.

In recording the growth experiments, the measurements were made with the triangular measuring instruments described in the report on "The Scallop Fishery of Massachusetts," 1910. The different periods of growth were checked by notching the edge of the shell with a file, in the same manner as used in the quahaug and clam experiments, which rendered identification and recording easy. The habits and enemies of the sea clam were observed at Monomoy Point, the spawning season at Monomoy Point and Wellfleet, and the data for the survey collected at different localities along the coast.

1. What are the names of the sea clam?

Mactra solidissima has several names, the most common being "sea clam," as it is styled in southern Massachusetts, while in the northern part of the Commonwealth it frequently goes by the name of "hen clam." In other parts of the country, because of its habitat upon the open coasts, it is called "surf clam" and "beach clam," while from the use of its shell it has acquired the local names of "dipper" and "skimmer."

2. To what family does the sea clam belong?

The sea clam belongs to the class of mollusks called the Lamellibranchia, which are characterized by an internal and external symmetry. According to the classification given by Pelseneer[1] in his work on the "Mollusca," *Mactra solidissima* is of the order *Eulamellibranchia,* sub-order *Tellinacea,* family *Mactridæ.* Geologically, the family of the *Mactridæ* extends from the cretaceous age to the present day. According to Verrill's[2] "Invertebrates of Vineyard Sound," *Mactra solidissima* is found fossil in the Post-Pliocene at Point Shirley, Chelsea, Mass.; and apparently in the Miocene of North and South Carolina. Smaller bivalves, which by some authors have been given the names of *Mactra lateralis, Mactra tellinoides* and *Mactra arctata,*

[1] A Treatise on Zoölogy, Part V., Mollusca, by Paul Pelseneer, D. Sc., London, 1906.

[2] A Report upon the Invertebrate Animals of Vineyard Sound, by A. E. Verrill, United States Fish Commissioner's Report, 1871–72.

are found in Massachusetts; while from Hatteras to Brazil is found a southern variety, *Mactra similis.*

3. Distribution: what is the range of the sea clam?

The range of the sea clam comprises the Atlantic coast, from the Gulf of Mexico to Labrador. It is found on the sandy bars of exposed coasts below low-water mark, and occasionally on flats exposed during the low-course tides. It is found from low-water mark to a depth of ten fathoms (Verrill).

4. What is the present extent of the sea clam beds in Massachusetts?

No large beds, as formerly existed at Dennis, Nantucket and Chatham, are known to the fishermen, although sea clams are found in more or less abundance at several places along the Massachusetts coast. The largest bed at the present time is at Monomoy Point, Chatham. In Plum Island Sound and Ipswich Bay sea clams are found on the low flats, but the fishing is limited to the low-course tides. Off Nahant, Hull and Winthrop are scattering beds of these large clams, which are occasionally washed ashore after storms. Sea clams are gathered off Plymouth by the fishermen. The numerous bars off Barnstable, Yarmouth and Dennis on the north side of the Cape furnish an extensive territory, while along the inner side of the Cape small beds are located at Wellfleet, Truro and Brewster. At Provincetown the fishermen thoroughly dredge the beds at Wood End in their search for bait.

On the outside of the Cape many shells are found on the beaches, showing that beds exist on the ocean side. At Chatham there is a fine bed at the present time. The south shore of Dennis formerly was a great locality for this mollusk, but few are now found. At Nantucket sea clams are now gathered in many parts of the harbor, principally from a large bed on Hussey shoal. Sea clams are also found near Cape Poge and on the shores of Martha's Vineyard. In certain waters of the Commonwealth the shells of this mollusk form the greater part of the shell deposits on the ocean bed. The principal fisheries are at Chatham, Provincetown and Plymouth.

5. What are the commercial uses of this mollusk?

The sea clam is used both for food and as fish bait. As a food it is not generally in favor, principally because its edible qualities, owing to its tough appearance, are not commonly known. It is prepared for the table in the form of sea clam pie, stew or chowder. Any diminution of the future supply of quahaugs will increase the popularity of the small sea clam, as there is no reason why this mollusk should not prove a valuable shellfish for the market. At the present time the chief demand for the sea clam is as bait, especially during the winter, when other forms of fish bait are hard to obtain.

6. What is the method of fishing?

The former method of gathering sea clams was by raking. Various kinds of rakes similar to the implements employed in the quahaug fishery were used, the style depending upon the depth of water. Now

these mollusks are taken by dredging, as it is possible to scrape sea clams from a sandy bottom with a dredge which will fail to extract quahaugs from a tenacious soil.

7. Has there been a decline during the last thirty years?

If reliance can be placed on historical writings, the present generation perhaps is witnessing the passing of the sea clam. While it is indeed true that the large beds, which once made Chatham, Dennis and Nantucket famous for their bait fishery, have passed away, the lack of authentic statistical figures for the past years, and the erratic nature of the fishery, large beds appearing first in one locality and then in another, lasting only a few years before they become exhausted, render any conclusions indefinite. Comparing the yield of 1907 and 1877 for Cape Cod, as given by E. Ingersoll,[1] we would find a decrease from three thousand barrels to a few hundred, which would imply a serious decline, were it not known that in 1877 the large bed at Dennis was in a flourishing condition. Nevertheless, it has been clearly demonstrated that whenever a large bed in any locality has been discovered it has been depleted in the course of seven years by overfishing. There are several specific examples of the depletion of large natural beds by ill-advised methods of fishing, which have contributed to the decline of the fishery.

8. What is the remedy for the depleted beds?

Usually, when a bed has been raked clean, nothing can be done; the remedy lies rather in preventive measures. By proper restrictions as to raking, the beds can be made to last longer, perhaps indefinitely, if a certain amount of "spawners" are saved and the young sea clams protected by a size limit. The sea clam furnishes the instance of a shellfish which it is advisable to protect by means of a size limit, in order to insure a greater return to the fisherman. But a size limit will only increase the yield of one particular set, and in order to successfully provide for future generations, it is necessary to leave part of the larger sea clams for "spawners" by setting aside certain portions of the beds.

Another remedy is the transplanting from outside areas of adult sea clams, which will act as "spawners" and possibly restock the depleted areas. This form of sea clam culture is worthy of trial in some of our waters. A similar method is artificial culture by private individuals, which will be considered in another part of this paper.

9. Anatomy.

The anatomy is described only in brief terms, to give the reader a general idea of the principal organs and their relation to the life and habits of the animal.

The Shell. — The shell is a smooth, calcareous structure, covered with a yellowish-brown epidermis, except at the umbones, where it is worn

[1] The Clam Fisheries, by Ernest Ingersoll, Section V., Vol. II., The Fisheries and Fishing Industries of the United States, 1887.

off, showing the white lime. The sea clam attains a large size, shells from five to six inches in length often being found on the beaches. Usually the size taken for market is between four and six inches, the size depending upon the length of time the bed has escaped the notice of the fisherman. The shape of the shell varies greatly, the usual form being eliptical, but occasionally they almost approximate a triangular shape. Fine concentric lines of growth are found over the exterior of the shell, with here and there one more prominent than the others. The shell consists of two equal valves, joined together dorsally by a hinge and ligament. A dark-colored elastic pad, similar to that of the scallop, is placed between two triangular depressions, one in each valve at the hinge line, and acts as a spring to force the valves apart in contra-action to the adductor muscles. The interior of the shell has a smooth, glistening appearance, due to the secretion of the mantle. On the hinge, extending horizontally from the triangular depression for the elastic pad, are two ridges, which interlock with the corresponding ridges of the opposite valve to form a strong hinge. Below the hinge line is a deep concavity passing outward to the umbo. Toward each end of the shell are two oval scars, corresponding to the attachment of the anterior and posterior adductor muscles. Connecting their lower margins is the pallial line, which marks the attachment of the mantle to the shell. Posteriorly this line takes an inward curve to form the pallial sinus, which corresponds to the attachment of the siphon.

The Internal Anatomy. — The sea clam should prove an excellent specimen for class room demonstration, as with the simplest dissection the different organs are clearly demonstrated to the pupil, possessing in this way an advantage over the more specialized clam, oyster and scallop.

(*a*) *The Mantle.* — On removing one valve a thin, transparent covering, the mantle, is noticed, closely lining the interior of the shell and enclosing the animal in a fleshy case when the thick yellow edges of the mantle lobes meet. The two mantle flaps are joined together except at the ventral (lower) edge for the extrusion of the foot. At the posterior end the mantle is joined in the form of two fleshy tubes, the siphons, corresponding to the "little neck" of the quahaug. The lower tube is the incurrent, through which the water enters the mantle chamber; the upper the excurrent, through which the water leaves the shell. When expanded these tubes, tipped with delicate tentacles, form a short "neck," projecting above the sand, through which food and water are sucked down to the buried sea clam. The chief function of the mantle is the formation of the shell, by the secretions of the cells on its edge and outer surface, which become impregnated with lime salts.

(*b*) *The Muscles.* — The two principal muscles are the anterior and posterior adductors, commonly known as the "eyes." They are situated a little distance from each end of the shell, and by their contraction

offset the action of the elastic pad on the hinge and thus keep the shell closed. When the action of the muscles ceases, as in a dead sea clam, the shell gapes open. In its burrow the shell gapes slightly as the muscles partially relax. Just dorsal to the attachments of the adductor muscles are the points of attachment of the foot retractors, which are useful in regulating the action of the muscular foot. The other important muscles of the body are the retractors of the mantle and internal fibers of the foot.

(*c*) *The Foot.* — The chief characteristic of the sea clam is its large, muscular foot, which has the shape of a broad dagger or arrow head. It is situated on the lower side of the visceral mass. The foot itself is a tough, flexible organ, composed internally of many cross bands of muscle running longitudinally and transversely, on the same plan as the minute structure of the mammalian tongue. In the upper portion, between the intervening bands, lie the sexual organs. The method of life of the sea clam on the exposed beaches has necessitated this strong and useful organ for locomotion.

(*d*) *The Gills.* — On removing the mantle, two delicate flaps, lined with vertical furrows, are observed hanging like the leaves of a book on each side of the foot and visceral mass. These lamellated structures are the inner and outer gills, the two inner uniting dorsally, the two outer being attached to the mantle, so that they hang down as four folds in the mantle chamber, separating it into an upper compartment directly connected with the excurrent siphon, and a lower connected with the incurrent siphon. Water passes into the lower chamber, bathing the gill bars, thus bringing oxygen to the blood inside the gills by diffusion, and receiving carbon monoxide. It then passes through an opening lined with cilia into the upper chamber, and thence out the excurrent siphon. The second function of the gills is the collection of the microscopic food, which is strained from the water by the cilia of the gills, and is carried in definite channels to the tip of the palps and thence to the mouth. The gills also assist in the removal of silt and other matter which may flow in with the water, thus evidencing a selective power in procuring food.

(*e*) *The Digestive Tract.* — The digestive system consists of the palps, which are exceedingly long and slender in the sea clam, and are situated in the form of a moustache on the upper and lower sides of the mouth. Their function is to receive the food from the gills and guide it into the mouth. A short œsophagus opens into a broad stomach, surrounded by a digestive gland, the liver, which is in communication with the stomach by two ducts. A long coiled intestine, containing in its upper part a large gelatinous rod, the crystaline style, leads from the posterior part of the stomach, and after passing through the heart ends near the posterior adductor muscle.

(*f*) *The Blood System.* — The circulatory system consists of a heart, situated in the upper part of the body posterior to the stomach, the

ventricle of which is pierced by the intestine. From this extend blood vessels anteriorly and posteriorly to the various parts of the body.

(*g*) *The Reproductive Organs.* — These glands are located in the visceral mass, just above the foot, and are spread around the coils of the intestine. In the female they contain the eggs; in the male, the spermatozoa in various stages of development, according to the season of the year. Considerable variation in size and color is noticeable.

10. When is the spawning season?

The spawning season comprises the two months of June and July, and attains its height during the last week in June and the first week in July. At Wellfleet in 1908 spawn was obtained from sea clams in the aquaria on the 10th of June. The season varies in different localities, according to temperature, spawning taking place earlier in the warmer waters.

11. How do sea clams spawn?

The sexual products are developed in glands situated in the visceral mass above the foot, the eggs in the female, the spermatozoa in the male clam. In either case the ripe spawn passes through a narrow opening into the mantle chamber, and is from there shot out of the excurrent siphon as a fine cloud into the water, where, after fertilization, the young sea clam enters upon an independent embryonic existence. In the aquaria the sea clams extruded the spawn in small quantities at successive intervals; but under natural conditions it may be possible for the entire contents of the glands to be liberated at once.

12. At what age does the sea clam spawn?

It is possible for the sea clam to produce mature spawn at the age of one year, but the first important spawning season occurs in its second year. Each succeeding summer the sea clam reproduces, the quantity of spawn increasing in proportion to the size.

13. The early life history.

The Egg. — The eggs are extruded in white clouds or in masses held together by brown connective tissue. The size of the sea clam egg is slightly smaller than the egg of the scallop, measuring one five-hundredth of an inch in diameter.

The Spermatozoa. — The spermatozoa pass out in a white cloud, which, on diffusion, gives a milky appearance to the water. The "milk" from the female clam has a granular appearance, due to the individual eggs, while that of the male has a homogeneous consistency. The individual spermatozoön consists principally of a head, which contains the important male cellular elements and a long cytoplasmic tail for locomotion.

Embryology. — Fertilization is accomplished by the union of the spermatozoön and the egg in the water external to both parents, the active male cell seeking the floating egg. In nature fertilization is largely a matter of chance, and, owing to the currents, winds and tides, a great percentage of the eggs never become impregnated.

The subsequent development of the embryo is by the process of unequal cell division, similar in all lamellibranch mollusks. The first polar cell is given off twenty minutes after fertilization, fifteen minutes before the first division into two cells. The four-cell stage is reached in the next thirty-three minutes. Repeated divisions give eight, sixteen, thirty-two, sixty-four, etc., cells, until the embryo reaches what is commonly known as the mulberry stage, where it consists of a compact mass of small cells surrounding a few large cells, which are to form the inner or endodermal layer. The surface cells acquire cilia, hair-like processes, in the course of nine to ten hours, and the embryo is able to swim aimlessly through the water. By the time it is twelve to fourteen hours old it has attained definite motion, has a primitive mouth, and traces of a shell gland are beginning to appear. A few hours later a shell gradually envelops the animal, which now enters upon the so-called veliger stage.

The Veliger Stage. — Between thirty and forty hours after fertilization the embryo is completely enveloped by a transparent shell, which has gradually extended over the soft parts. The animal is still a swimming form, locomotion being effected by an organ called the velum, which is a circular pad lined with a fringe of strong cilia, a direct modification of the anterior ciliated area of the previous stage. During the spawning season the water is full of swimming shellfish veligers. In about five days the velum gradually disappears, giving place to a slender, active foot, which functions first as a swimming and later as a crawling organ. The young sea clam is now ready to settle to the bottom and take up its life in the sand.

The Set. — Observations are lacking on the early set of sea clams. No byssal attachment, such as is found with the young clam and quahaug, has been observed in this form; but, as the nature of its early life would indicate the need of such an organ, there is reason to believe that a byssus may be present at an early stage. The set consists in the animal leaving its free-swimming existence in the water and taking up its life in the sand. At this time the young sea clam measures about one one hundred and twenty-fifth of an inch, and has most of the characteristics of the adult.

14. Locomotion.

Anatomically, the shape and size of the foot suggest an active crawling existence, such as the animal's method of life would indicate. The muscular foot is capable of great activity, and can push the shell along the sand by its forceful thrusts, — a frequent means of travelling.

Crawling. — In a similar manner to the quahaug, crawling is accomplished by working the extended foot into the sand, and by its contraction bringing the shell after it with a tipping movement. In this movement the siphon brings up the rear. No observations have been made on the rate of crawling, except that the sea clam can travel faster than the quahaug. Another method was observed in young sea clams,

one-quarter of an inch in length, in water six inches deep; the young animals apparently hopped along, moving nearly an inch at each kick of the muscular foot.

Jumping. — A curious instance was recorded at Monomoy Point on sea clams, one and four-fifths inches in length, which were lying on the sand in a box at a depth of two to three inches from the surface of the water. A sea clam at one end of the box suddenly extended its foot, and by a twisting kick sent its body in one leap through the water and air in a beautiful arch, covering a distance of eight inches. This performance was repeated several times by the other clams in the box. By such a means it is possible for the clam to travel much faster than by crawling, and accounts for the ease in surmounting enclosures less than three inches above the sand.

Swimming. — The sea clam, like the razor clam, by a kicking movement of the foot can glide for a short distance through the water, — a method of locomotion which might possibly be styled swimming. Rarely more than one kick is taken in these flights, which are not of common occurrence.

Burrowing. — The sea clam, when exposed, can burrow within a few minutes, either when the water is over it, the easier and more natural way, or when exposed on the damp soil. It is also capable of crawling when exposed between the tide lines. Burrowing, like crawling, is accomplished by the extension of the foot and the resultant downward pull on the shell by its contraction.

12. Do sea clams migrate?

The escape of the sea clams planted in the first bed, a pen with sides only one inch above the sand, definitely settled all question of their ability to move, but gave no information as to the rate and length of their migrations. Later observations were made on the movement of the sea clam in the following manner: stakes, three by two inches, were driven in the sand, sea clams placed around with end of shell touching stake, so that the slighest change in position could be determined. Observations were made both between the tide lines and below low-water mark. (1) Stakes were driven between the tide lines in the channel connecting the Powder Hole and the ocean at Monomoy Point, and sea clams one and four-fifths inches in length placed around them. After twenty days only four out of the twenty-nine originally planted were found in a radius of eight feet. (2) Similarly, at a depth of two feet at low water seven were planted. In three days five were found, in fourteen days three, and in thirty-eight none. The sea clams between the tide lines showed a greater tendency to move than below low-water mark, possibly being less satisfied with their environment.

There seems no question that the sea clam can move from one part of the flat to another. The writer has seen small sea clams (two inches in length) work across a sand flat partly by their own exertion, partly by tidal action. They are well equipped for travelling, but apparently have

little sense of direction. For this reason it is doubtful if extended migrations occur, as the sea clam would have no reason for leaving a favorable environment. The idea that whole beds of sea clams migrate hither and thither is probably erroneous, and the depletion of a bed can only come from overfishing or through the destructive powers of nature.

16. What are the feeding habits?

The mantle lobes unite posteriorly to form two short tubes, the excurrent and incurrent siphons. Through the lower or incurrent siphon water is sucked into the mantle chamber, as the sea clam lies under the sand with the tip of the siphon reaching the surface. By the action of the cilia on the gills, which hang as four perpendicular flaps in the mantle chamber, the food is strained from the water, which passes into the upper mantle chamber and thence out through the excurrent siphon, bearing the waste products. The food is taken by definite channels to the ventral part of the gills, and from there to the edge of the long palps, where it is caught up by other ciliary currents and transferred to the mouth. In its normal position in the sand the sea clam feeds continually, a constant stream of water entering and leaving the shell.

The food of the sea clam, like other bivalved mollusks, consists chiefly of microscopic plant forms, called *diatoms,* tiny forms, found in more or less abundance in all waters. These minute plants have a wondrous variety of shapes, but are identified by their silicious covering.

17. What are its natural enemies?

The enemies of the adult sea clam can be classified in two groups: (1) adverse physical agencies; (2) living forms. The second group can be subdivided into (*a*) active enemies, which prey directly upon the sea clam; and (*b*) passive enemies, which indirectly injure or affect its life. This last group, while large, is of relatively little importance, and contains the forms which partake of the same food or affect the sea clam in any way.

Besides man, the chief active enemy is the common winkle or cockle (*Lunatia heros* and *L. duplicata*), which perforates the shell at the umbo by a beautifully countersunk hole by means of a rasping tongue, and sucks out the contents. The sea clam appears to be the special prey of this gastropod mollusk, which likewise attacks the clam and quahaug, though to a less extent. Nearly all the sea clam beds are infested with them, as the numbers of bored shells on the beaches testify, great quantities being destroyed annually by this enemy. The following observations were made on one hundred and fifty-nine shells taken from the beach at Monomoy Point: (1) the perforation is made either on the right or left valve, according to chance; (2) the usual location of the hole was one to three millimeters from the beak; (3) the size of the hole varied from a fraction of a millimeter to five milli-

meters, according to the size of the winkle; (4) often the shell was not completely perforated, showing that the enemy sometimes had to abandon the attack; (5) the perforation is not always at the umbo, but may be found along the median line, even within two millimeters of the edge of the shell. Various sea fowl also prey upon the small clams.

The natural elements play an important part in the destruction of the sea clams, particularly in regard to the young larvæ, which perish in large numbers during the cold rains, changes in temperature, winds, currrents, storms, etc. The adult sea clam itself does not escape the ravages of the elements, as quantities are annually washed ashore in gales, to perish on the exposed beaches.

18. How long does it take to furnish a marketable sea clam?

Rate of growth varies according to the location, in respect to current, tide and other physical conditions; therefore, the following answer will not apply in all cases. However, there is more uniformity in the growth of sea clams in their exposed beds than with the other shellfish, as the location on the sandy bars swept by the tides and current are favorable for rapid growth. Unfortunately, it proved impossible to obtain the rate of growth on the natural beds, owing to their exposed conditions, and the experiments on the rate of growth were made in more sheltered places. The results from the beds situated in the "current" should most nearly approximate the growth under natural conditions, and the rate of growth of the sea clams is given from the favorably situated beds.

Considering a three and one-quarter inch sea clam as of marketable size, such can be obtained two and one-half years from the time it is spawned; *i.e.*, by the third winter be ready for market. By the second winter, one and one-half years old, the sea clam should measure two and five-eighths inches, as it acquires its largest growth the second summer of its life. It is therefore recommended that a growth period of not less than two and one-half years be given before capture, as the two and five-eighths inch clam is scarcely of sufficient size for marketing, and a substantial gain in volume is obtained by waiting an additional year. Beds of sea clams will be found where the rate of growth may be less than the above citations, as all beds cannot be favorably situated in respect to the natural conditions.

19. What is the average annual growth?

Starting with a twenty-five millimeter sea clam, the size it attains at the age of six months (January 1), the average annual growth will be twenty-two millimeters (seven-eighths of an inch) for the next three years. Naturally the growth during the first year is greater than the second, and the second greater than the third, as the sea clam grows more slowly as it increases in size. These figures were obtained under favorable conditions for growth.

20. What is the growth of the sea clam for the first five years of its life?

The sea clam hatched July 1, 1905, by Jan. 1, 1906, would measure twenty-five millimeters (one inch) in length; Jan. 1, 1907, it would measure sixty-five millimeters (two and five-eights inches), showing a gain of forty millimeters (one and three-fifths inches); Jan. 1, 1908, eighty millimeters (three and one-fifth inches), a gain of fifteen millimeters (three-fifths of an inch); Jan. 1, 1909, ninety millimeters (three and three-fifths inches), a gain of ten millimeters (two-fifths of an inch); Jan. 1, 1910, ninety-eight millimeters (three and seven-eighths inches), a gain of eight millimeters (one-third of an inch); and July 1, 1910, one hundred millimeters (nearly four inches).

21. What are the growing months?

The sea clams in the raft boxes at Monomoy Point in 1906 were measured at monthly intervals, to determine the relative value of the different months. The greater part of the shell formation takes place during the summer months; but the sea clam, unlike the quahaug and the scallop shows a slight growth during the warmer winter months, which is only noteworthy as illustrating the fact that the clam (*Mya arenaria*) and sea clam, as cold water species, are able to keep in an active feeding state longer than the two former. In the following table each month is given a number representing the gain per cent. for that month, the entire year being considered as one hundred per cent. The table is made on the basis of the growth of a forty-millimeter (one and three-fifths inches) sea clam, starting January 1. No allowance for slowing of growth in regard to size is made. On examination of the table, it will be noted that the two best months are August and September, while the growth during April, November and December is of slight consequence.

Months.	Per Cent.	Months.	Per Cent.
January,	–	July,	16.75
February,	–	August,	24.00
March,	–	September,	23.00
April,	3.75	October,	10.00
May,	6.00	November,	2.50
June,	12.75	December,	1.25

22. How old are the large sea clams?

The answer to this question is at best but a calculation, as sea clams have been under observation for only five years, which but rarely carries them beyond four and one-half inches. The large, heavy specimens, measuring from five to six inches, must be at least ten years old and possibly more, as the larger clams grow more slowly. Growth varies according to the environment, and if the sea clam is unfavorably situated it will take longer than ten years to reach the maximum size.

23. How does the growth of the sea clam compare with the clam and the quahaug?

Under similar conditions, the growth of the sea clam is between the growth of the quahaug and the clam, but more nearly approximates the growth of the clam. In fact, a series corresponding to the weight of the shell would read, in order of rapidity of growth: clam, sea clam, and quahaug, — the heavier-shelled animals showing the slowest increase. In amount of gain per year for the same sized specimens (one inch) the figures would be roughly: clam, two inches; sea clam, one and five-eighths inches; quahaug, seven-eighths inch, under excellent growing conditions.

24. Can sea clams grow out of sand? If so, can it be made of economic importance?

As sea clams obtain their nourishment from the water, the exact relation of soil to growth is problematical. In conducting experiments upon this subject it was found that sea clams, when suspended in wire baskets (one and one-quarter inch mesh) at a depth of five feet from a raft in the Powder Hole, Monomoy Point, increased in size, proving that a covering of sand, their natural environment, was not necessary for growth. The method of growing out of sand did not prove as efficient as in the natural environment; the gain for the year only totalling 12.25 millimeters, as compared with 40.45 millimeters for the sea clams in the boxes with sand. The growth for the first month proved much less than the average for the following months, being 4.14 times smaller than it should have been. This check was due to the change in environment, as the sea clams required some time to adjust their feeding powers to the changed method of life. The same observations have been made on quahaugs confined in wire baskets. When taken up the shells were covered with a mass of barnacles, silver shells (*Anomia*), crepidula, etc. From a practical standpoint, while it is worth while to know that sea clams can be successfully kept in wire baskets out of the sand and held this way for the market without serious loss, it is not recommended as a method of culture, as the slow growth of the sea clams would render any basket culture unprofitable.

25. Do sea clams grow between the tide lines?

The sandy bars inhabited by the sea clams are frequently exposed at the low-running tides, when these mollusks are gathered for market as in Plum Island Sound. Often sea clams are found wandering between the tide lines. So not infrequently the sea clam is left exposed by the water, and is accustomed to life between the tide lines. Growth, however, is not so rapid as when the water is constantly over the bed, as the feeding time is limited. At Monomoy Point a bed was tried between the tide lines near a channel connecting the Powder Hole with the ocean at high tide. The bed received a good circulation of water, but was only covered a few hours a day. The growth for the year amounted to 11.5 millimeters, which is poor compared with the more

favorable growth, 40.45 millimeters, on the raft, where, besides having good circulation, water was constantly over the clams. For every quart planted in between the tide lines 2.15 quarts were obtained, as compared with 8.15 quarts for the sea clams on the raft.

26. What are the conditions influencing the growth of the sea clam?

The rate of growth of the sea clam depends upon two factors: (*a*) the amount of food; (*b*) the amount of lime salts in the water for shell formation. The growth in wire baskets shows that the mineral matter of the shell is derived from the water. The quantity of lime determines the weight and rapidity of shell formation. The question of food is even more important than that of lime, as the soft parts must increase in bulk before the shell can enlarge. The greater part of the food of the sea clam consists of microscopic plant forms, called diatoms, which are more or less abundant in all waters. The sea clam sucks these little forms through its siphon, as is described under the feeding habits.

(*a*) *Current.* — The natural habitat of the sea clam places it where it can get good circulation of water. The chief office of the current, in addition to sweeping away pollution, is that of food carrier. Therefore, as growth depends on food, the fastest-growing localities would be where a good current brought more food to the sea clams. A rapid current is not necessary, as merely a good flow of water is essential for the growth of all shellfish. As experimental evidence of the effect of current, the following examples are cited. In 1906 boxes containing sea clams were under observation on the raft and near the shore at Monomoy Point. On the raft was a good circulation of water; near the shore only the rise and fall of the tide caused any flow of water. The result for sea clams 40 millimeters in size was as follows: in one year's time the shore sea clams gave an increase of 12.04 millimeters, or 2.2 quarts for every quart planted. On the raft a gain of 40.45 millimeters was recorded, or a gain in volume of 8.15 quarts for every quart planted. The only difference was in the circulation of water. The two places were only 100 yards apart.

(*b*) *Tide.* — The effect of tide, in exposing the animals, is injurious to growth in two ways: (1) in the severe winters the exposed sea clams may perish; (2) it limits the feeding time. The effect of exposure has already been cited, in considering the subject of growth between the tide lines.

(*c*) *Soil.* — Sea clams are invariably found in sand, especially on the bars rippled by the action of the waves. Probably the clean sand affects the sea clam only as a resting place. There is little chemical action on the shell such as has been noted on clams in muddy organic soils; and the smooth sand is less prolific in diatoms than are the numerous mud flats, which furnish the breeding grounds of this microscopic food.

27. Additional facts derived from the growth experiments?

(1) *Variation in the Different Years.* — In growth in the raft boxes from 1906 to 1910 the average of each year gave the following results, showing considerable variation in 1908 and 1910. Owing to the few boxes in use each year, the variation may be due wholly to the boxes themselves; but it is also believed that these two years showed less growth than the other three, although the difference may possibly be exaggerated by the peculiarities of the boxes and their position.

	Mm.
1906,	40.45
1907,	37.00
1908,	27.00
1909,	42.81
1910,	32.92
Average,	36.04

(2) *Box Growth compared with Pen Growth.* — In 1906 experiments were made in three places: (1) between the tide lines, which gave an average of 11.49 mm.; (2) on the raft, which gave an average of 40.45 mm.; (3) on the south side of the Powder Hole near the shore, in about two feet of water at low tide. Here sea clams were planted both in boxes and in beds made by driving boards into the sand. The average for the pens was 4.57 mm., practically but little growth; while the boxes situated exactly under the same conditions but raised slightly above the sand with projecting sides gave a gain of 12.04 mm., or over two and one-half times as much. No explanation is offered for this fact, which has been likewise recorded for clams and quahaugs in other experiments in which the box growth exceeded the bed growth.

28. Can the sea clam be cultivated?

As an edible shellfish, the sea clam may some day become important, and it is not an impossibility that the small sea clam may replace the "little neck" as a table delicacy, if the diminution in the supply of quahaugs cannot soon be checked by cultural methods. The sea clam has a strong, sweetish flavor; but there is no reason to believe that the public taste could not be educated to "sea clams on the half shell" if "little neck" prices become prohibitive. At the present time there is little call for sea clams except for use as fish bait. Until the demand for this mollusk is sufficient to render the returns from sea clam culture as remunerative as those from clam and quahaug farming, little attention will be given to sea clam planting. At the present time artificial culture is impossible, owing to the legal difficulties which stand in the way, as described at length in our "Report upon the Mollusk Fisheries of Massachusetts," 1909.

Two methods of culture can be employed with the sea clam: (1) individual planting on private grants. This has been shown impractical

at the present time, both from a legal and a financial standpoint. Sea clam culture is possible, as the growth experiments have demonstrated the rapid growth under cultural conditions. Planting will have to be done in pens made either of netting or boards projecting one foot above the sand, in order to confine the active sea clams. To manufacture such pens will cost but little, and when the legal difficulties are removed and the demand for sea clams has increased, there is no reason why sea clam farming cannot be made a profitable business. (2) Communal culture offers a satisfactory means of protecting the fishery, as by the importation of "spawners" the flats and waters which have been raked clean can once more be made productive. Often attempts, such as the bedding of quantities of large sea clams upon the depleted flats, will fail, as there is no positive assurance that the spawn will catch on these flats, only the chances are greatly increased of its "setting" in the immediate vicinity. In this speculative way the towns may restock their waters by local action.

29. Recommendations.

Until the shellfisheries are put on a cultural basis under the proper laws, nothing remunerative in artificial propagation can be done for the sea clam. The question at the present time is the protection and conservation of the natural supply by careful regulation. Such legislation naturally comes under the control of the towns, whose duty it is to see that proper regulations are imposed for the maintenance of the fishery within their borders. The regulation should be along the following lines: —

(1) The protection of the small sea clams, by the proper enforcement of a size limit. In this way larger returns would be insured by the growth of the small sea clams, and the fishery would last longer.

(2) Preservation of "spawners," by setting aside certain portions, thus protecting the large sea clams, which furnish the greater part of the spawn. In this way the bed could never be depleted by overfishing, as has been the case in past years, when all the "spawners" were taken, without regard to the future welfare of the fishery.

(3) Restrictive legislation by the town, to insure the best market returns and the prevention of overfishing.

(4) Restock the barren areas by the transplanting of adult sea clams as "spawners."

Utilization of Public Waters as a Source of Food Supply.

No one can doubt that the food supply is a fundamental basis of existence, or that a straitened food supply may lead to social, political and economic chaos. Long ago Lord Macaulay made this prediction to an American friend: "The day will come when the multitude of people, none of whom has had more

than half a breakfast or expects to have more than half a dinner, will choose a legislature. Is it possible to doubt what sort of a legislature will be chosen? . . . There will be, I fear, spoliation. The spoliation will increase the distress; the distress will produce fresh spoliation. . . . Either civilization or liberty will perish."

In proportion to our area, Massachusetts has relatively little farm land, and what we have is peculiarly liable, from the configuration of the surface, to loss from erosion of plant food (chiefly in the forms of nitrates and nitrites) from the soil. But this loss is in some measure offset by the peculiar configuration of our seashores. When under natural conditions, before the advent of civilization, this waste of nitrates and nitrites was so utilized in the tidal waters as to result in a very large production of mollusks and crustacea, which are a very valuable food for man. Thus did nature conserve this natural resource, by utilizing along the shore the normal waste of the uplands. But, now, as a result of unwise legislation, the people are not permitted to utilize this source of food and wealth. Neglecting the waters, we farm the land solely, and only there strive to assist nature to an increased yield of human food per acre. By our farming operations we increase in an approximately corresponding degree the flow of nitrates and nitrites into the waters, where under proper economic conditions it should indirectly produce an increased yield of crustacea (lobsters and edible crabs) and mollusks (oysters, clams, quahaugs, scallops, etc.) in the shallow waters of the coast. Instead of utilizing these conditions, however, we make the tidal areas a desert by killing as many as possible of the lobsters before they have reached the breeding age; by unsystematic digging we destroy a large proportion of the growing clams, in order to get a few large ones "before some one else does;" we sell at a low price the breeding quahaugs, and the growing quahaugs under the breeding age at a higher price. Instead of planting our "seed" clams and quahaugs we ship them for planting in other states. These planters reap large profits from which our short-sighted policy precludes our own citizens. We either destroy the scallops before they have laid their single litter of eggs, or we waste a considerable proportion of the normal market supply by delaying until late autumn the capture of the

large ones which have already spawned and therefore are of no further use in increasing the number of young, until such a time in the winter as unnecessarily high prices may be obtained; or, worst of all, and as completing the unwise existing trend of public and private ignorance and negligence, we destructively inundate these tidal flats, valuable above any farming land in the potential food productive capacity, with a flood of unspeakable refuse and detritus of civilization. Not alone is it a well-recognized municipal practice to turn sewage, garbage and manufacturing wastes without let or hindrance into such public waters, in violation of decency, of sanitary and economic laws, but we permit the relatively few clams and quahaugs which may survive to be eaten by the very class which can least afford to meet unnecessary illness and expense. The State can better support in idleness the ignorant fisherman who digs clams ostensibly for bait but in fact for food than permit these clams to become available for food. We speak whereof we know, when we say that a large majority of the clams and quahaugs dug "for bait," under permits of the local boards of health in Boston, Lynn and New Bedford harbors, are ultimately used for food. This practice exists in spite of 355 arrests and convictions in the past six years, since the practice was forbidden by law. We have said in another report ("Report upon the Mollusk Fisheries of Massachusetts," 1909) that the dumping of the metropolitan sewage into Boston harbor destroys annually more than $400,000 worth of food which should be received from that area for the benefit of the citizens of Massachusetts. The figures relative to Lynn and New Bedford harbors are even proportionally greater. A considerable proportion of the pollution is unnecessary, in the sense that the polluting material could be disposed of on land at equal or less expense and with greater economic results.

Pollution of Streams. — Attention has been called many times to the inadequacy of the present laws relative to pollution in its effect upon fish life. Under the law the commission acts only upon cases of pollution by sawdust, but as the law reads at present, shavings and wood-manufacturing refuse of various kinds, which are equally as destructive as sawdust, can be put in with impunity. In a smaller way, many manufacturers unnecessarily turn into our streams materials which could

more efficiently and cheaply be cared for on land. It is a curious fact that the Commonwealth forbids such polluting material to be turned upon land of an individual, but it may be put upon the public lands and waters with absolute impunity, resulting in a waste of material which with a little more care could often without additional expense be profitably utilized on land, instead of resulting in the destruction of public property and public rights.

The aspect of this most conspicuous to the public is the pollution of certain rivers and streams which empty into the sea near clam and quahaug beds. The resulting pollution of the shellfish grounds constitutes a most insidious danger to the public health. In spite of our remonstrance, passage was secured of a law (Acts of 1907, chapter 285) by which shellfish in certain polluted areas, from which the taking of shellfish is prohibited by the State Board of Health, may be used for bait, provided they are not sold. This law is absolutely impossible of enforcement, for the reason that the officer is compelled, in the nature of the case, to keep those same shellfish under observation from the time they are dug until the time they are used as bait. Biological examination indicates that clams and quahaugs from these areas are dangerous as conveyers of typhoid fever germs. Certain evidence has come to our attention of typhoid fever cases in the families of poor fishermen who are known to be violators of this law. We repeat our recommendation that the digging of shellfish from this area should be absolutely prohibited, until such time as the danger of contagion is removed. If, however, some arrangements can be made whereby the mollusks from polluted regions can be placed for at least a month in uncontaminated waters, it would render them safe for use as food, though the danger to the diggers, and through them to their families and the public, would not be entirely eliminated. Such arrangements would be possible under an adequate system of leases for mollusk cultivation.

Recreational Fishing. — With the increase of population of our cities, the demand becomes more important for a sane type of recreation such as is furnished by fishing. Many of the best streams of the Commonwealth are passing into private ownership, by which the public are excluded. The time is not far

distant when it will be necessary for the Commonwealth to consider the advisability of securing for the benefit of the public the most important streams in various sections of the State, and keeping those streams stocked in such a manner that reasonably good fishing can be maintained, instead of sending out a large number of trout the greater majority of which are wasted by being improperly liberated or placed in unsuitable streams.

In this connection we again respectfully call attention to our recommendations that an investigation can be made of the productive capacity of the various types of public waters in the State, with a view to determining the quantity of food fish which could be annually produced. This work has been successfully carried on in Switzerland, in Germany and in other European countries, where the problem of food supply is more urgent than in the United States. The extent and methods of stocking the streams of the State with food and game fish have long been notoriously inadequate. Legislative action is necessary to meet the requirements.

Inland Fisheries.

Distribution of Fish and Eggs during 1909.

Fry distributed,	802,000
Fingerlings distributed,	152,200
Adult fish put out,	2,823
Fish eggs distributed,	1,000,000
Number of brooks stocked with fry,	137
Applications filled for fry,	145
Number of brooks stocked with fingerlings,	255
Applications filled for fingerlings,	246
Great ponds stocked,	19
Rivers stocked,	3

Hatchery Expenses during 1909.

Adams,	$204 47
Hadley,	261 24
Sutton,	[1]5,171 74
Winchester,	142 38
	$5,779 83

[1] Including trout eggs purchased (400,000 at 50 cents per 1,000), $200.

Summary of Output of Fish and Pheasants during 1909.

Description.	Fry.	Fingerlings.	Adults.	Eggs.	Pheasants.
Brook trout,	802,000	130,900	1,073	-	-
Brown trout,	-	17,800	75	-	-
Rainbow trout,	-	3,500	-	-	-
White perch,	-	-	1,675	-	-
Smelt eggs,	-	-	-	1,000,000	-
Pheasants,	-	-	-	-	668
Totals,	802,000	152,200	2,823	1,000,000	668

That part of the report of the superintendent of the Sutton Hatchery relating to the propagation of trout follows: —

To the Commissioners on Fisheries and Game.

Gentlemen: — I herewith submit a report on fish cultural work and other work connected with the same.

Though natural conditions were somewhat adverse, the present season has shown much better results in fish cultural work through the improvements carried out in the past two years. The production of eggs was increased to 900,000 and the fingerlings to 155,000, — over twice the average for the past three or four years, and there is ample assurance that further increase is practical and safe.

The season of 1908 ended with a severe drought, and, while this did not interfere with carrying a much larger stock of breeders and fingerlings than usual, or in any way affect the quality or yield of eggs, it caused considerable loss during the winter as the eggs developed, and by weakening the embryos endangered the whole stock through greater liability to disease. This condition was brought about through shrinkage of the only available water supply for the hatchery, for the reason that another pipe drawing from a more abundant source has become so clogged as to be useless. The supply of water through December and January was less than one gallon per minute for 100,000 eggs; but the shipment of 200,000 eggs to Winchester gave some relief, and soon after our increased flow made it possible to carry the eggs and fry until the outside troughs could be used. These troughs, placed at the springs and operated under conditions similar to what is proposed for the new hatchery, developed the fry rapidly, and supplied so vigorous a stock for the rearing ponds that the early loss was the least experienced, and many thousand fry intended for rearing were not required and were distributed as advanced fry. These fry, that at the first to the middle of May were shipped 5,000 to the ten-gallon can, could not by the middle of May be shipped more than 500 to the can.

The eggs collected in 1908 for hatching in 1909 amounted to 750,000, 57,000 of these being brown trout.

The stock of brown trout that yielded these eggs was kept in the pool below the dam formerly used only for keeping large fish for exhibition purposes, the restricted space seemingly making it impracticable to keep a considerable number of breeders. In 1908 this pool was enlarged and partly concreted, and during the two succeeding seasons carried its stock so well that when it is completed as planned it can undoubtedly be depended upon to yield 100,000 eggs yearly. The brown trout fry were reared in the pens below the dam, and 16,000 were distributed, 800 being reserved as breeders.

The capacity for trout fingerlings was increased by the addition of two concrete ponds. Some of the older ponds yielded more by increasing the shade. The one pond which was considered to be insufficiently shaded (No. 3), suffered a severe loss, and came through to the end of the season stocked to little more than half its capacity. Several ponds yielded less than the usual number, but this was more than made up by the heavy yield of others, especially the group built in the weeded ground just below the principal spring supply. It is evident that if all the ponds could be made to yield to the full capacity of each the output would be more largely increased, and the most promising step towards securing this is shading and protecting the more exposed ponds. The work that has been done is of such value and is so necessary to keep up the yield and check the raids of predatory birds that it ought to be more profitable to build permanent coverings, rather than to continue the makeshift structures of brush and bagging now in use.

The ponds built in the woods are well shaded, but need covering for the purpose of keeping out the falling leaves. Where the shipment of fingerlings is long delayed, the leaves blow in and often fill the ponds nearly to the surface of the water. This endangers the fish, and results in long-continued and vexatious work in separating the fish and the leaves.

Fifty thousand rainbow trout eggs, forwarded by the United States Bureau of Fisheries, were received and hatched in December. This early hatching at the time of an extreme shortage of water made it impossible to give them proper accommodations, and by the time that the season was so advanced that they could be moved outside, they were in an enfeebled condition. The pond in which they were placed froze over frequently, interfering with regular feeding, thus causing further loss, so that by the time the weather moderated and permitted the pen below the dam to be occupied they were greatly reduced in number. Placed in this water, which has been found to agree best with them, they thinned to a marked degree, and 3,500 fingerlings of the largest sizes were distributed.

As in past years, improvements for increasing the rearing capacity were undertaken only after careful consideration of the effect on

existing facilities, and so far no curtailment elsewhere has resulted by reason of any extensions. The concrete ponds built the present season were constructed of heavy concrete, possibly the most enduring work on the place. Though they were on water already used, it was plainly capable of further use. On the east side, the new pond used the water flowing from the outside troughs; on the west side, the water from the west ponds was used again; and in the construction of the pond there the concrete was continued to form a dam for the large west pond, replacing the mud dam.

Below the hatchery the brook was changed into a runway, built of concrete slabs supported by a chestnut frame, as the soft bottom was not favorable for the heavy work built on the hard ground above the pond. This runway is intended for yearling spawners, and will undoubtedly carry enough so that the pond used so many years for yearlings can be used for rearing fingerlings, thus increasing the output of those by fully 20,000. An extension of this runway up the brook to the dam would materially increase its capacity, and would prevent the troublesome wash from the muck beds along this part of the stream into the completed part, and, by permitting the use of covers, would keep out the leaves from the heavy growth of hard wood between the meat house and hatchery.

Below this runway and extending for 100 yards down the brook the conditions are very favorable for a larger and deeper extension that would carry a large stock of adult brown trout. The water as it leaves the present runway is still good, and at this point it receives the drainage from the four lower rearing ponds, while further down a good supply of unused spring water flows in, and this locality is believed to offer the best prospects for flowing wells.

The outside troughs were found so useful that stands were built for increasing the number from 16 to 40, and lumber to make the increased number, with double-hinged covers for the whole 40, was bought and fitted.

In August a 2 horse-power gasolene engine was added to the equipment for preparing food. An addition to the meat and ice house was put up to shelter it, and later a refrigerator with overhead ice chamber was constructed in this building. In addition, conditions about the meat house were greatly improved by tearing out the wooden floor and laying one of concrete, and by building concrete steps and walk from the driveway on the dam. The wall extending along the dam from the steps was torn out and replaced with concrete, in order to break up a troublesome resort of rats.

The floor of the hatching house had so far decayed that it fell into the mud beneath, and therefore, over that part used for hatching purposes, would not support the troughs. As permanent repairs were not desired, the floor was broken up and the débris thrown into the mud to support a filling of sand and gravel. The filling was mainly of sand,

with four inches of well-tamped gravel for a surface. The waste water was carried away in a cemented ditch.

The removal of the outside tub stand, repairs to the building and troughs, new head trough, changes in piping and heater, made the expenditure of labor unfortunately large for such temporary work.

Many other improvements were carried out about the buildings and grounds, though partly with reference to bird work. Grading and terracing was done, to get better locations for the brooders; underbrush was cut, to facilitate moving coops; land was cleared of stumps for plowing, in order to do some experimental planting for breeding coops; fences were put up, to keep visitors under better control; concreting for ratproofing was done wherever practical; and many small improvements were made, valuable in the aggregate, for guarding the safety or facilitating the handling of the fish or birds.

The continued improvement of the station has resulted in a greatly increased capacity, with less liability to loss from disease and accident; and the further improvements approved will, when carried out, make it possible to get a still larger yield of eggs and fingerlings, and in addition to feed a large number of fry to the stage called advanced fry, — a change that would largely increase the fish-cultural value of the place.

Further work of improvement is desirable, for it is certain that what is contemplated does not utilize the water flow to its full capacity or in the best way; and an important part of this work must still be in replacing the earlier construction with permanent work, which so far has hardly kept pace with the rate of decay.

It is well known that rearing fingerlings was not contemplated when the station was located and constructed, and that the equipment for this work, as well as for rearing pheasants, grouse and quail, has been added yearly, with the expense not in any way separated from the ordinary operating expenses.

The deficiencies of equipment have been made up each year as circumstances would permit, and the necessity of constantly adding has at all times hampered each season's work of production, for many years keeping that of fingerlings down to a point much lower than a proper number, and more recently interfering in developing the bird work.

The recommendations previously made for additional land and a safe road are renewed, but the need of these and of a proper hatching house have been stated in detail before.

Respectfully submitted,

ARTHUR MERRILL, *Superintendent.*

GAME AND INSECTIVOROUS BIRDS.

While there is an urgent demand for pheasants for liberation, and although these birds are known to be active feeders upon injurious insects and their larvæ, including both the gypsy

and brown-tail moth, we are of the opinion that a greater degree of attention should be bestowed upon the maintenance of our native birds, — the quail as an unrivalled insect destroyer, and the ruffed and pinnated grouse as food and game birds. Of these we have demonstrated beyond question that an experienced person can under suitable conditions rear to an age suitable for liberation a much greater number of young birds than a pair of wild quail would normally produce, not to mention the undoubted advantages of breeding from selected individuals, thus progressively increasing size, productivity and other desirable qualities.

In the case of grouse, the problem of mating the birds is the most troublesome.

While the general consensus of opinion is that the ruffed grouse has this year increased in certain localities under the more favorable conditions existing, the areas where this bird has in recent years become uncommon or even absent are annually becoming more extensive. Attempts to rear this grouse in captivity have resulted solely in experience.

Quail are again becoming established in favorable localities. This bird can without doubt be reared in large numbers under suitable conditions.

Birds distributed during 1909.

Number of pheasants distributed,	669
Applications filled,	76
Applications unfilled,	57

That part of the report of the superintendent of the Sutton hatchery which covers the rearing of pheasants, grouse and quail, follows: —

To the Commissioners on Fisheries and Game.

Gentlemen: — I herewith submit a report on raising pheasants, grouse and quail for 1909.

The work on pheasants, grouse and quail was carried on, as usual, in connection with fish-cultural work, therefore it was under the disadvantage previously noted, that the attention the work deserves could not be given, and that the data collected are neither so complete nor so conclusive as was hoped. However, the work of the season, considering the practical side, was far more successful and encouraging than any yet, inasmuch as many unlooked-for results were achieved in the breed-

ing and rearing processes, with positive demonstration that simpler and easier methods could be employed.

The results, viewing the work as one of experiment and investigation are: (1) that feeding and the care of young or old presents no difficulties except in so far as the feed of the old birds may affect the vitality of the embryos or young, and (2) that infectious diseases do not present the menace formerly feared, provided that sufficient intelligent and careful attention is given; (3) that maintaining maximum vitality in the breeding birds and their progeny is the most serious problem to be considered at present. A study of the influences that affect it is of the utmost importance.

The breeding of grouse was continued in an experimental way, but with good results. Of the breeding lot of four birds, one female was killed in the winter by swallowing a rifle shell; another was killed by the male in mating; the third nested in one of the large pens, laid 9 eggs and hatched 5, but failed to raise any chicks. Twenty eggs from wild birds were brought by Deputy Mecarta, the first lot of 11 hatching 7 chicks, 1 a monstrosity, 1 noticeably weak; these and 1 other died, the remaining 4 growing to practically full size. The second lot of 9 eggs all hatched; 2 died and 7 were reared.

Both lots were reared in brooders with the ordinary 4 by 6 inch brooder coop attached, and seeded with grass, clover and buckwheat. This vegetation supplied green food; other food consisted of curdled milk with shredded wheat, custard and maggots. Fine grain was given as they needed it; fruit was given in small quantities, but no attempt was made to supply insects. The food given was sufficient for a most vigorous growth.

When the chicks were not quite a month old they were moved to larger coops seeded with buckwheat, and a month later were moved again.

Early in September they were moved from the brooder ground to the hill west of the pond, where they thrived until late in October, when one of the first lot died. The cause was recognized as amœbic disease, and this was confirmed by examination of another bird by Dr. Tyzzer. The birds were separated upon discovery of the disease, but 2 more died, 1 of the 4 escaping infection.

The second lot developed a very quarrelsome disposition, and were separated into small lots, but before this was done one was so badly injured that it was liberated.

The results with these grouse as compared with the results of previous years showed that with good sanitary conditions and proper temperature the feeding and care of the young was not a more difficult matter than with quail or pheasants; and in these lots, as with previous ones, the characteristic contentment in close quarters when growing up, with quarrelsomeness when near maturity, and friendliness with attendants or strangers, was noted.

Work with grouse in the immediate future lies in devising suitable breeding methods. Their disposition makes it difficult to keep them even in very small flocks, and it is apparently impossible to breed them in small pens except singly, and then only with constant attention to the safety of the hen from the attacks of the cock. This procedure would so increase the equipment and labor for any extensive breeding that it might make practical results impossible. Of the experimental work that might be suggested for overcoming these difficulties, the most promising may be to attempt breeding in the unused hare pen of nearly two acres. This is natural breeding ground for grouse, except for the lack of underbrush, which was destroyed by the hares, but which is rapidly growing up. The present deficiency, however, is made up in part by a growth of weeds. The fence is high enough to hold pinioned birds, is proof against invasion by any animal, and the danger from hawks is not great in the grouse breeding season. Either to allow the birds to incubate their own eggs or to collect and hatch the eggs, permitting continued laying, would give results of some value; the latter might be preferable, for it has not yet been shown that a captive bird would lay a second clutch. Allowing the birds to rear their own young might well follow later, when there is a proper undergrowth to conceal them.

The stock of breeding pheasants and the output of young was increased twofold over last year. The egg yield per bird was increased from 50 to nearly 60, totaling 4,300; and the hatching was better, resulting in nearly 2,000 chicks, — a number so large that the former percentage grown could not be maintained, and dropped from 60 to 35, but from causes which could be avoided under suitable conditions, as will be shown below. Fertilization was very good, rising as high as 90 per cent. at mid-season, but falling very low at the last. The best lot hatched 80 per cent., but some failures brought the average down to below 50 per cent.

The rearing was satisfactory in the earlier lots, where proper control could be kept over them; but poor in the later lots, where the great numbers overcrowded the coops and the available open grounds where protection could be given, and made it necessary to place them in the more exposed and dangerous places. Birds similarly placed the year before, but in small lots, did finely, exceeding all other lots in percentage raised and in condition; but the more extended operations this year invited numerous enemies, and several of the largest lots were successively reduced to 50 or even to 25 per cent. during the first two or three weeks; and when moved to the open lower ground in front, where some measure of protection could be given, were attacked by roup. This infection remained and decimated them for over two months. Two lots hatched subsequently to these were placed for safety near the weedy ground bordering the brook, and, while safe here from hawks and cats, suffered quite as much from rats, and later with the

other lots lost many from roup. A hen hovering a brood in one of these lots developed a mania for killing them when they were about a week old, and had killed 50 of her own and neighboring broods when discovered.

All of these lots mentioned were reared under hens. Some earlier lots placed under hens and kept in near the buildings did very well, but it was necessary to reserve some of this ground for quail work.

The brooders were used all through the season when they could be spared from quail work, and gave fair results in all cases. Some lots so grown were excellent in condition and numbers; as a rule, though, the numbers placed in the brooders were too large to give the best results.

As the birds reached the age of one month they were put in portable coops and kept until ready for distribution; but owing to delays in this work the coops were crowded, and therefore did not give the best results. The insufficient amount of land for moving them was also a severe handicap, and when late in the season there was little hope of reasonable success for the last lots, additional land was rented and the coops moved outside. This afforded some relief from the unfavorable conditions which were largely responsible for the drop in the number of birds from 990 at the age of one month to 668 distributed or reared.

Pheasant rearing, when attempted on a larger scale than the few hundred that can be accommodated here, by reason of the limitations placed upon it by the quail and grouse work and the narrow bounds of the State property, can hardly be done with proper economy. If the scale of work is increased, it should be to such an extent that it will be profitable to do it by itself, with ample room, and with the birds properly guarded, so that they can be grown in the open, securing immunity from disease, and more vigorous birds than penned-up ones would be. As done here, the facilities and methods were adapted to working in a small way, incidental to the fish-cultural work. The number handled could be kept in close to the buildings, guarded and cared for with little trouble. The more successful large establishments use ample range room, developing their birds more rapidly and better, with considerable saving in the cost of caring for them in coops and loss from intestinal and other diseases due to confining them in coops, which must fairly offset the cost of guarding them in the open and the loss from predatory enemies. As a suggestion for a practical change in methods for the next year, it is recommended that the work of rearing the young be moved to some point outside where safe and ample range can be secured, retaining that part of the work within the grounds that cannot be easily moved or that requires little space for carrying it on, such as the breeding pens and pens for retaining and shipping grown birds.

The breeding stock of quail was divided into 27 lots, 24 lots of one pair of birds, 2 lots of 2 pairs, and 1 lot of 5 pairs. The lot of 5

pairs was somewhat broken up by the escape of several birds, but while together they mated and laid well-fertilized eggs. One lot of 2 pairs in a small pen laid rather better than the other 2-pair lot in a large pen. The following table shows the size of pens, the number of birds in each and the eggs laid: —

Pen No.	Area (Square Feet).	Number of Birds.	Eggs laid.	Infertile Eggs.	Remarks.
1,	192	1 pair	28	6	Youngest female hatched Oct. 8, 1908; small, inferior eggs.
2,	144	1 pair	41	4	Female incubated 15 eggs; hatched 14; raised 12 chicks.
3,	144	1 pair	27	4	
4,	144	1 pair	38	13	
5,	144	1 pair	65	3	
6,	144	1 pair	63	8	
7,	144	1 pair	42	19	Female attempted to incubate 15 eggs; left nest.
8,	144	1 pair	20	6	
9,	144	1 pair	38	4	
10,	32	1 pair	77	5	Female attempted to incubate 12 eggs; left nest.
11,	32	1 pair	102	2	
12,	32	1 pair	28	5	Escaped about middle of laying season.
13,	32	1 pair	1	–	Female killed by male after one egg was laid; not known if egg was fertile.
14,	32	1 pair	–	–	Youngest female, hatched October 8.
15,	64	1 pair	83	2	Female attempted to incubate 10 eggs; disturbed by rats.
16,	64	1 pair	31	3	
17,	32	1 pair	67	19	
18,	32	1 pair	56	3	
19,	32	1 pair	44	2	
20,	32	1 pair	57	12	
21,	32	1 pair	80	1	Female, assisted by male, incubated 12 eggs; eggs eaten by rats.
22,	35	1 pair	85	9	
23,	72	1 pair	41	28	Male sick.
24,	64	1 pair	60	6	
25,	1,300	2 pairs	79	8	One female attempted to incubate 18 eggs, but the eggs were taken away for fear of rats.
26,	2,000	5 pairs	84	15	Three pairs died or escaped in laying season.
27,	144	2 pairs	110	20	One female incubated 12 eggs; hatched 7; raised 2 with no assistance.
			1,447	207	

Some valuable data were secured from the hatching work, as the number of eggs was large, and was laid by birds kept under somewhat diverse conditions and to some extent of known antecedents. The

records kept were sufficient to indicate the hatching quality of each bird's eggs, and to denote to some degree what may be considered the transmitted stamina in the embryos and young; and these facts, relating to hereditary influences or as affected by environmental influences incidental to the breeding and hatching processes, are perhaps the most important matter for study in future quail work. Previously, in quail, grouse and pheasant hatching unexpected and unaccountable weakness has been shown in the embyros at times, and the effect has been attributed to what has been considered the most immediate cause. This might be (1) inbred stock; (2) weather conditions, such as excessive winter cold affecting the vitality of the breeders, or either excessive cold, heat or moisture in the nesting season affecting the eggs; or (3) unsuitable practice in incubation. Nothing was observed this year to make it appear at all probable that any one of these mentioned had a predominant influence, but possibly any or all may be contributary causes.

It was noted in the report for 1908 that one quail laid 100 eggs, and that these hatched chicks of noticeable vigor even to the last. The quail grown from these eggs and others known to be descended from prolific layers, while laying well themselves, did not transmit the vigor of their parents to their own eggs, for among these the greater loss from dead embryos and weak chicks was noted.

There is a correlation between the failure of the embryos to hatch and the loss of young chicks directly after hatching, the heavier loss of young chicks following in the lots that showed the greater number of dead embryos. What influences and to what extent they acted in producing this effect is largely conjectural, and the opinion that the trouble is mostly from transmitted weakness is formed only after a study of possible causes, with no evidence of any positive effect from environmental processes or conditions upon embryos or young. The inferior eggs come alike from the very small and the largest hens; the best eggs come from some of the small hens. A study of methods of incubation gave no light. Where incubators were used to finish the hatch, they gave varying results, though but little different from corresponding lots left under hens. In both cases the unfavorable results suggested overheating, so during a considerable period the temperature of the hens was taken, and a rather wide variation noted, the ordinary temperature of 104° to 105° rising at times to 108° to 109°. A hen with this higher temperature, sitting very close, near to the time of hatching, might injure the eggs; and this hypothesis was apparently confirmed when it followed an abnormal temperature in several cases, but in some succeeding cases the same results were reached without the same temperature to cause it.

It has been assumed that the hens would not air and cool their eggs as much as might be required, and it has been the practice to shut them off the nests an hour in cool or moderate weather and longer in hot weather,

but so far without proof that the practice was correct, or any good reason to change it. However, the very contradictory results with eggs set at the same time and given identical treatment indicate that the results in the matter under consideration are not influenced by the way the hens are handled, unless individual cases call for different treatment.

Of the 1,447 eggs laid by the quail, 19 were discarded or broken in handling; 65 were spoiled or destroyed in the pens; 207 were infertile; 128 were broken under hens; 286 were fertile, but had well-developed dead embryos; 50 died in hatching or immediately after; 691 hatched to all appearances normally, but in many lots aggregating 176 chicks weakness quickly developed, and of these latter few reached the age of one week and none lived over three weeks.

The difference was very clearly marked in the quality of the chicks in the lots defined as good as distinguished from the poor. In the latter there was invariably a heavy loss the first day or two, before any feeding was done or any probability of disease being introduced. A continuous loss to the end was characteristic, the birds at any age appearing to be feeble and spiritless. Pathological examinations of specimens failed to show any infection that would account for their condition or death.

The better birds, including some intermediate lots that did only fairly well, showed a vigorous, healthy growth through this stage, and a small loss, even nothing in some cases. Of 515 hatched, 361 grew to the age of one month, well past the danger from feeble development or any disease or functional disorder that the young might be more sensitive to, and subject only to loss from more controllable causes.

The pens used for the birds up to and past this age were used experimentally the year before with favorable results, and again this year with entire satisfaction, in regard to results and labor required in using them. They are 3 by 6, 4 by 6 or 4 by 8, with top partly open and partly covered. When placed for use they were filled with three inches of loam carted in from the woods, and seeded to clover, grass and buckwheat, which was allowed to get a reasonable start before the birds were put in, and when properly started gave a better supply of green food than could be given in any other way. These coops were seeded in succession, so that the birds could be moved at intervals to fresh ones. As long as this plan was followed there was freedom from losses, with but a single exception, where a lot of 12 was killed by an intestinal disease. At length, however, through increasing number of birds, it became no longer possible to move the coops freely, and larger coops were brought into use on newly terraced ground west of the pond. Some of these larger coops were filled with fresh loam, others placed on soil brought to the surface in terracing. After being here several weeks without loss, disease broke out and destroyed 5 lots,

numbering 80 birds, within a very brief period. Five other lots on the same ground, 3 of quail and 2 of grouse, escaped infection. Later the same disease attacked 2 lots on the brooder ground nearer the barn, and 30 birds were lost, but it made no further appearance. The attack was fatal to every bird in the lots infected. In the first lot where it appeared the last bird of 19 was dead in two and one-half days from the time the first one was found. In another instance, 2 birds escaping from an uninfected lot were accidentally put in with a diseased lot; they contracted the disease and died in from four to five days. The progress of the disease was somewhat less rapid in some lots, where perhaps it was not communicated from one to another so quickly; but the infected birds were sick for only a brief period, and as a rule showed no emaciation.

This disease is considered to be of bacterial origin, and the same that was in some grouse in 1908 and quail in 1907, similar lesions in the intestines being noted in every bird examined. These lesions gave a very characteristic spotted appearance to the lower part of the intestine; but the liver and cæca, usually the infected parts in the case of coccidial or amœbic disease, in most cases appeared normal. The origin of the disease at this place is difficult to account for, unless it was the surviving infection from the use of the ground two or more years previous, the terracing operations not covering the infected soil. For some weeks after the loss from these attacks the birds did very well; but late in October, when the congestion of work greatly delayed the moving of coops, a group on the west side containing brooder birds hatched about mid-season, and another group on the south side containing hen-raised birds, began to die from what was recognized as the same disease in both lots, but not previously noted here. Dead birds from all lots were submitted to Dr. E. E. Tyzzer, who diagnosed the disease as "acute nephritis, resulting in the deposition in the tissues of material (largely amorphous wastes) normally excreted by the kidneys."

The cause of this disease, in its successive appearance and disappearance in different lots, suggests that it is a functional disease caused by certain conditions, and may be remedied by changes that are really an adherence to the methods that have been recommended as the best. The disease appeared in certain lots hatched about mid-season that were not nearly as well developed as the earlier lots, probably on account of being kept with but few changes to fresh coops; and when this condition was noted, they were divided into smaller lots in larger coops and placed on fresh but rather bare ground, where they were soon wholly without incentive to scratch. To make up their deficient growth, they were well fed; thus it followed that their food and exercise was not properly balanced, and this disease, or practically "bird gout," resulted. When the necessity of moving appeared, these birds were

transferred to small coops and placed on a piece of newly seeded ground with a growth of weeds, clover and stunted millet, where they were moved at intervals and came through the winter without further loss. Although on a more restricted diet, they matured as well as the older lots.

The hen-raised lots from the south side were transferred to the large breeding pens, and the same beneficial results followed. After a brief interval the older lot suffered the same loss under similar conditions; and the remedy was to place them in the older large pens, previously idle on account of being infested by rats, but about this time cleared of rats and made ready for use. Later the same disease appeared among some of the younger lots and breeding birds, and was remedied in the same way; and the origin appeared in these lots as well as in the others to result from delay in shifting coops and some incidental overfeeding. During the period that this disease was prevalent the pressure of work made it necessary to do what was the most urgent, and the amount of time consumed in filling, levelling and brush cutting for placing coops was so great that no ordered routine could be followed in moving them. A proper balance between the means of doing this work and the necessities of it has been hard to maintain, and delays in doing many things have occurred because some other part demanded more urgent attention. This condition is partly incidental to carrying on several branches of work frequently demanding coincident attention, and partly to doing the work on unimproved ground, which in regard to quail work has been found to be the least suitable, as it is practically prohibitive of a satisfactory routine in growing them. This, as it appears from the experience to the present time, is to continue with the small brooder coops, using them in weekly or fortnightly succession, with fresh loam and tender vegetation each time, until the chicks can be taken from heat, which may be at the age of one month, and then put in larger portable coops on ground that will admit of moving them at frequent and regular intervals. For this purpose no ground used yet is as satisfactory as the ground that can be planted and cultivated to a very smooth condition. Penned quail are very persistent scratchers, and, while the ground that has been in use here — rough, with more or less rocks, stumps, underbrush and fallen leaves — is good for the time being, the birds soon dig it over and eat any tender vegetation, and their removal to fresh ground entails considerable labor. Old sod ground is objectionable, the grass being too dry and tough in the growing season for quail, and the sod much too tough for scratching. The advantage of specially prepared ground is in growing what the quail need most in their pens, — weeds, unripe grain, clover and any tender vegetation that they can eat, and in supplying these with less labor than they can be gathered and fed; also in encouraging scratching, which in keeping them busy is a great aid in keeping them healthy.

The trials that have been made here suggest that a light sandy or gravelly soil, that would grow a stunted or a scrub vegetation, and furnish loose, easily opened surface, would be suitable. This is suggested as the best plan for extending the work and doing it with a reasonable amount of labor, and is probably the most practical for growing good birds; the need of which could be clearly seen in the backwardness of lots that could not be given the conditions for good growth that others had, or the quicker way that disease worked in these lots, and the change for the better when bad conditions could be remedied.

The loss from the kidney disease was approximately 100 birds. Other losses included 20 killed by rats in two raids; a smaller number, about 10, killed by birds getting mixed in pens, usually where one escaped into an adjoining pen or was put into the wrong pen after recapture. A single bird getting into a flock was quite often killed, but it was always safe to mix flocks of the same size. The loss from incidental causes included a few that escaped and were picked up by prowling enemies; many more that died from undetermined diseases, mostly intestinal, and doubtless including many cases of coccidial or amœbic infection.

The part that this disease plays in affecting quail-rearing is not at all clear, and probably will not be until extensive pathological work is done at the place of rearing. It does not appear to have caused much loss among the growing quail, and these only occasional cases, while the very probable exposure to it of many lots was without apparent effect. In the cases where it was the apparent cause of death, the birds dying were greatly emaciated and sick a noticeable length of time, and their death was not followed by continued loss, as though the victims were birds of low vitality, and the more vigorous ones had power to resist its action. This infection seems to have quite the same effect on both quail and pheasants in producing a slow, emaciating disease. In grouse, however, the disease is more rapid in its effects and spreading. In the cases mentioned of probable exposure of birds to coccidial infection, those mentioned were seven lots of quail grown under hens taken from the flock considered to be infected with coccidia. This of course could not be determined, but if they did, it could hardly have had any effect on the chicks, as what losses were met with were accounted for in other ways, the birds generally doing quite as well as the brooder lots.

The results with these lots are herewith given, as being of interest in showing what can be done with bantams: —

Lot Number.	Number hatched.	Number at Age of One Month.	Lot Number.	Number hatched.	Number at Age of One Month.
2,	14	7	21,	23	9
12,	19	12	23,	24	20
14,	18	13	25,	19	15
17,	12	10			

The heaviest loss in lot 21 came the first night, when 10 were apparently stepped on by the hen. Lot 23 was in the region where the bacterial disease broke out in September, and was destroyed in a few days.

This experimental work has been so encouraging that it is well to try it more thoroughly another year, and if it can be done with proper pathological work, we might determine to what extent quail-rearing can be done with bantams, which, were it not for the necessity of considering disease, seems a more practical way than with the use of incubators and brooders, as the equipment and labor required is much less.

Respectfully submitted,

Arthur Merrill.

The Deer Problem.

The deer problem in this State is a complicated one. The majority of land owners and city residents sojourning temporarily in the country enjoy the occasional sight of a deer on the landscape. From this point of view the animal is thus an attractive and valuable asset to the community.

On the other hand, a large group of people regard the deer as a source of sport and food. The head, hide and meat of a good specimen would bring $25 and upwards, if placed on the market. To the farmer and fruit grower, market gardener and nurseryman deer are a costly and unmitigated nuisance. Even the $8,000 paid by the State Treasurer to settle claims of damage to crops by deer does not in the aggregate cover the actual damage done, since in many instances the damage to orchards and nurseries cannot be repaired by money.

From the facts which have come to our notice, we are of the opinion that deer have not increased in numbers during the year. We judge that 1908 showed the high-water mark of

recent years in the deer population, and that now effective checks to their further increase have come into action; such as, notably, the law permitting deer to be shot when in the act of damaging crops, supplemented by the considerable number killed by trains and trolley cars, by wire fences, and the "moving accidents of flood and field."

Summary and Comparison of Deer Statistics, 1907, 1908 and 1909.

	1907.	1908.	1909.
Deer seen,	1,298	2,035	1,594
Deer chased by dogs,	114	120	72
Deer seen damaging crops,	85	100	227
Deer shot illegally,	40	36	49
Deer killed by trains and trolley cars,	25	60	55
Deer shot while in the act of damaging crops,	16	17	198
Dead from other causes,	47	83	82
Totals,	1,625	2,451	2,277
Live deer,	1,497	2,255	1,893
Dead deer,	128	196	384
Totals,	1,625	2,451	2,277
Notices issued relative to dogs chasing deer,	27	37	30
Court cases: —			
Dogs chasing deer,	5	2	5
Killing, hunting or wounding deer,	6	15	22
Number of reports from which above statistics were tabulated,	503	700	589

Enforcement of Law.

That branch of our duties which relates to the enforcement of law has been under the immediate direction of Chief Deputy Nixon. The list of paid deputies, with their district, residence and telephone number follows: —

WILLIAM W. NIXON, *Chief Deputy,* Central Office, State House. Telephone, Hay. 2700; residence telephone, 466-2 Cambridge.

Assigned to District —	NAME.	Residence.	Telephone Number.
1	Everett B. Mecarta,	Harwich,	36-4
2	Samuel J. Lowe,	New Bedford,	761-2
3	Allen A. David,	Taunton,	966-1
4	Charles E. Tribou,	Brockton,	2101
5	William H. Leonard,	East Foxborough,	Foxborough 9-4
6	George H. Brown,[1]	Quincy,	-
6	Benjamin A. Foster,[1]	Roxbury,	-
6	Orrin C. Bourne,[1]	Malden,	1071-4
7	Edward J. Cogan,	Gloucester,	348-L
8	Thomas L. Burney,	Lynn,	1613-13
9	Walter A. Larkin,	Andover,	172-5
10	James I. Mills,	Ayer,	51-2
11	James E. Bemis,	South Framingham,	226-J
12	Irving O. Converse,	Fitchburg,	53-14
13	A. D. Putnam,	Spencer,	75-4 or 75-6
14	John F. Luman,	Palmer,	17-5
15	Dennis F. Shea,	Ware,	132
16	James P. Hatch,	Springfield,	2571-3
17	Lyman E. Ruberg,	Greenfield,	376-R
18	Arthur M. Nichols,	North Adams,	391-12
19	Fred R. Zeigler,	Pittsfield,	362-11
20	DeWitt Smith,	Great Barrington,	72-6
21	Charles L. Savery,	West Tisbury,	-

[1] Central office, State House.

The following were employed as special paid deputies: —

NAME.	Residence.	Time of Service.
Charles H. Gehle,	Westfield,	Sept. 25-Nov. 30, 1909.
A. H. Eldredge,	Ware,	Oct. 28-Nov. 30, 1909.
Allan Keniston,	Edgartown,	June 3-Nov. 30, 1909.
John P. Murphy,	Greenfield,	Sept. 25-Nov. 30, 1909.
Bradford A. Scudder,	Taunton,	Sept. 23-Nov. 30, 1909.
Albert L. Stratton,	Gardner,	Sept. 30-Nov. 30, 1909.
F. M. Truesdell,	Great Barrington,	Sept. 23-Nov. 30, 1909.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included.

4 Abington.
10 Acton.
2 Acushnet.
18 Adams.
16 Agawam.
20 Alford.
7 Amesbury.
15 Amherst.
9 Andover.
8 Arlington.
12 Ashburnham.
10 Ashby.
17 Ashfield.
11 Ashland.
12 Athol.
3 Attleborough.
13 Auburn.
5 Avon.
10 Ayer.
1 Barnstable.
15 Barre.
20 Becket.
9 Bedford.
15 Belchertown.
5 Bellingham.
8 Belmont.
3 Berkley.
10 Berlin.
17 Bernardston.
8 Beverly.
9 Billerica.
11 Blackstone.
16 Blandford.
10 Bolton.
6 Boston.
1 Bourne.
10 Boxborough.
9 Boxford.
13 Boylston.
6 Braintree.
1 Brewster.
4 Bridgewater.
14 Brimfield.
4 Brockton.
14 Brookfield.
6 Brookline.
17 Buckland.
9 Burlington.
6 Cambridge.
5 Canton.
10 Carlisle.
4 Carver.
18 Charlemont.
14 Charlton.
1 Chatham.
9 Chelmsford.
6 Chelsea.
18 Cheshire.
19 Chester.
16 Chesterfield.
16 Chicopee.
21 Chilmark.
18 Clarksburg.
12 Clinton.
6 Cohasset.
17 Colrain.
10 Concord.
17 Conway.
19 Cummington.
19 Dalton.
15 Dana.
8 Danvers.
2 Dartmouth.
5 Dedham.
17 Deerfield.
1 Dennis.
3 Dighton.
13 Douglas.
5 Dover.
9 Dracut.
14 Dudley.
10 Dunstable.
4 Duxbury.
4 East Bridgewater.
16 East Longmeadow.
1 Eastham.
16 Easthampton.
3 Easton.
21 Edgartown.
20 Egremont.
15 Enfield.
17 Erving.
7 Essex.
8 Everett.
2 Fairhaven.
3 Fall River.
1 Falmouth.
12 Fitchburg.
18 Florida.
5 Foxborough.
11 Framingham.
5 Franklin.
2 Freetown.
12 Gardner.
21 Gay Head.
9 Georgetown.
17 Gill.
7 Gloucester.
19 Goshen.
1 Gosnold.
13 Grafton.
15 Granby.
16 Granville.
20 Great Barrington.
17 Greenfield.
15 Greenwich.
10 Groton.
9 Groveland.
15 Hadley.
4 Halifax.
7 Hamilton.
14 Hampden.
18 Hancock.
4 Hanover.
4 Hanson.
15 Hardwick.
10 Harvard.
1 Harwich.
17 Hatfield.
9 Haverhill.
18 Hawley.
18 Heath.
6 Hingham.
19 Hinsdale.
5 Holbrook.
13 Holden.
14 Holland.
11 Holliston.
16 Holyoke.
11 Hopedale.
11 Hopkinton.
12 Hubbardston.
10 Hudson.
6 Hull.
19 Huntington.
6 Hyde Park.
7 Ipswich
4 Kingston
2 Lakeville.
12 Lancaster.
19 Lanesborough.
9 Lawrence.
19 Lee.
13 Leicester.
19 Lenox.
12 Leominster.
15 Leverett.
9 Lexington.
17 Leyden.
11 Lincoln.
10 Littleton.
16 Longmeadow.
9 Lowell.
14 Ludlow.
12 Lunenburg.
8 Lynn.
8 Lynnfield.
8 Malden.
7 Manchester.
3 Mansfield.
8 Marblehead.
2 Marion.
11 Marlborough.
4 Marshfield.
1 Mashpee.
2 Mattapoisett.
10 Maynard.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included — Concluded.

5	Medfield.
8	Medford.
11	Medway.
8	Melrose.
11	Mendon.
7	Merrimac.
9	Methuen.
2	Middleborough.
19	Middlefield.
8	Middleton.
11	Milford.
13	Millbury.
11	Millis.
6	Milton.
18	Monroe.
14	Monson.
17	Montague.
20	Monterey.
16	Montgomery.
20	Mount Washington.
8	Nahant.
1	Nantucket.
11	Natick.
5	Needham.
18	New Ashford.
2	New Bedford.
15	New Braintree.
20	New Marlborough.
15	New Salem.
7	Newbury.
7	Newburyport.
6	Newton.
5	Norfolk.
18	North Adams.
9	North Andover.
3	N. Attleborough.
13	North Brookfield.
9	North Reading.
16	Northampton.
13	Northborough.
13	Northbridge.
17	Northfield.
3	Norton.
6	Norwell.
5	Norwood.
21	Oak Bluffs.
15	Oakham.
17	Orange.
1	Orleans.
20	Otis.
14	Oxford.
14	Palmer.
13	Paxton.
8	Peabody.
15	Pelham.
4	Pembroke.
10	Pepperell.
19	Peru.
12	Petersham.
12	Phillipston.
19	Pittsfield.
18	Plainfield.
5	Plainville.
4	Plymouth.
4	Plympton.
15	Prescott.
12	Princeton.
1	Provincetown.
6	Quincy.
5	Randolph.
3	Raynham.
8	Reading.
3	Rehoboth.
8	Revere.
19	Richmond.
2	Rochester.
4	Rockland.
7	Rockport.
8	Rowe.
7	Rowley.
12	Royalston.
16	Russell.
12	Rutland.
8	Salem.
7	Salisbury.
20	Sandisfield.
1	Sandwich.
8	Saugus.
18	Savoy.
6	Scituate.
3	Seekonk.
5	Sharon.
20	Sheffield.
17	Shelburne.
11	Sherborn.
10	Shirley.
13	Shrewsbury.
15	Shutesbury.
3	Somerset.
6	Somerville.
15	South Hadley.
16	Southampton.
11	Southborough.
14	Southbridge.
16	Southwick.
13	Spencer.
16	Springfield.
12	Sterling.
20	Stockbridge.
8	Stoneham.
5	Stoughton.
10	Stow.
14	Sturbridge.
11	Sudbury.
15	Sunderland.
13	Sutton.
8	Swampscott.
3	Swansea.
3	Taunton.
12	Templeton.
9	Tewksbury.
21	Tisbury.
20	Tolland.
7	Topsfield.
10	Townsend.
1	Truro.
10	Tyngsborough.
20	Tyringham.
13	Upton.
13	Uxbridge.
8	Wakefield.
14	Wales.
5	Walpole.
11	Waltham.
15	Ware.
2	Wareham.
14	Warren.
17	Warwick.
19	Washington.
8	Watertown.
11	Wayland.
14	Webster.
11	Wellesley.
1	Wellfleet.
17	Wendell.
7	Wenham.
13	West Boylston.
4	West Bridgewater.
14	West Brookfield.
7	West Newbury.
16	West Springfield.
20	West Stockbridge.
21	West Tisbury.
13	Westborough.
16	Westfield.
10	Westford.
16	Westhampton.
12	Westminster.
11	Weston.
2	Westport.
5	Westwood.
6	Weymouth.
17	Whately.
4	Whitman.
14	Wilbraham.
16	Williamsburg.
18	Williamstown.
9	Wilmington.
12	Winchendon.
8	Winchester.
18	Windsor.
6	Winthrop.
8	Woburn.
13	Worcester.
19	Worthington.
5	Wrentham.
1	Yarmouth.

List of Cities and Towns included in Each District assigned to Deputy Fish and Game Commissioners.

District No. 1.

Deputy Everett B. Mecarta, Harwich.

Telephone, 36–4.

Barnstable.
Bourne.
Brewster.
Chatham.
Dennis.
Eastham.
Falmouth.
Gosnold.
Harwich.
Mashpee.
Orleans.
Provincetown.
Sandwich.
Truro.
Wellfleet.
Yarmouth.

District No. 2.

Deputy Samuel J Lowe, New Bedford.

Telephone, 761–2.

Acushnet.
Dartmouth.
Fairhaven.
Freetown.
Lakeville.
Mattapoisett.
Marion.
Middleborough.
New Bedford.
Rochester.
Wareham.
Westport.

District No. 3.

Deputy Allen A. David, Taunton.

Telephone, 966–1.

Attleborough.
Berkley.
Dighton.
Easton.
Fall River.
Mansfield.
North Attleborough.
Norton.
Raynham.
Rehoboth.
Seekonk.
Somerset.
Swansea.
Taunton.

District No. 4.

Deputy Charles E. Tribou, Brockton.

Telephone, 2101.

Abington.
Bridgewater.
Brockton.
Carver.
Duxbury.
East Bridgewater.
Halifax.
Hanover.
Hanson.
Kingston.
Marshfield.
Pembroke.
Plymouth.
Plympton.
Rockland.
West Bridgewater.
Whitman.

District No. 5.

Deputy William H. Leonard, East Foxborough.

Telephone, Foxborough 9–4.

Avon.
Bellingham.
Canton.
Dedham.
Dover.
Foxborough.
Franklin.
Holbrook.
Medfield.
Needham.
Norfolk.
Norwood.
Plainville.
Randolph.
Sharon.
Stoughton.
Walpole.
Westwood.
Wrentham.

District No. 6.

Chief Deputy William W. Nixon, Central Office, State House.
Telephone, Hay. 2700; residence telephone, Cambridge 466–2.
Deputy Benjamin A. Foster.[1] Telephone, Roxbury 1948.
Deputy Orrin C. Bourne.[1] Telephone, Malden 1071–4.
Deputy George H. Brown, Quincy.

Boston.	Hingham.	Quincy.
Braintree.	Hull.	Scituate.
Brookline.	Hyde Park.	Somerville.
Cambridge.	Milton.	Weymouth.
Chelsea.	Newton.	Winthrop.
Cohasset.	Norwell.	

District No. 7.

Deputy Edward J. Cogan, Gloucester.
Telephone, 348–L.

Amesbury.	Manchester.	Rowley.
Essex.	Merrimac.	Salisbury.
Gloucester.	Newbury.	Topsfield.
Hamilton.	Newburyport.	Wenham.
Ipswich.	Rockport.	West Newbury.

District No. 8.

Deputy Thomas L. Burney, Lynn.
Telephone, 1613–13.

Arlington.	Marblehead.	Salem.
Belmont.	Medford.	Saugus.
Beverly.	Melrose.	Stoneham.
Danvers.	Middleton.	Swampscott.
Everett.	Nahant.	Wakefield.
Lynn.	Peabody.	Watertown.
Lynnfield.	Reading.	Winchester.
Malden.	Revere.	Woburn.

District No. 9.

Deputy Walter A. Larkin, Andover.
Telephone, 172–5.

Andover.	Dracut.	Lowell.
Bedford.	Georgetown.	Methuen.
Billerica.	Groveland.	North Andover.
Boxford.	Haverhill.	North Reading.
Burlington.	Lawrence.	Tewksbury.
Chelmsford.	Lexington.	Wilmington.

District No. 10.

Deputy James I. Mills, Ayer.
Telephone, 51–2.

Acton.	Concord.	Pepperell.
Ashby.	Dunstable.	Shirley.
Ayer.	Groton.	Stow.
Berlin.	Harvard.	Townsend.
Bolton.	Hudson.	Tyngsborough.
Boxborough.	Littleton.	Westford.
Carlisle.	Maynard.	

[1] Assigned to launch "Egret" and to special duty.

District No. 11.

Deputy James E. Bemis, South Framingham.

Telephone, 226–J.

Ashland.	Marlborough.	Southborough.
Blackstone.	Medway.	Sudbury.
Framingham.	Mendon.	Waltham.
Holliston.	Milford.	Wayland.
Hopedale.	Millis.	Wellesley.
Hopkinton.	Natick.	Weston.
Lincoln.	Sherborn.	

District No. 12.

Deputy Irving O. Converse, Fitchburg.

Telephone, 53–14.

Ashburnham.	Lancaster.	Royalston.
Athol.	Leominster.	Rutland.
Clinton.	Lunenburg.	Sterling.
Fitchburg.	Petersham.	Templeton.
Gardner.	Phillipston.	Westminster.
Hubbardston.	Princeton.	Winchendon.

District No. 13.

Deputy A. D. Putnam, Spencer.

Telephone, 75–4 or 75–6.

Auburn.	Northborough.	Sutton.
Boylston.	Northbridge.	Upton.
Douglas.	North Brookfield.	Uxbridge.
Grafton.	Paxton.	West Boylston.
Holden.	Shrewsbury.	Westborough.
Leicester.	Spencer.	Worcester.
Millbury.		

District No. 14.

Deputy John F. Luman, Palmer.

Telephone, 17–5.

Brimfield.	Ludlow.	Wales.
Brookfield.	Monson.	Warren.
Charlton.	Oxford.	Webster.
Dudley.	Palmer.	West Brookfield.
Hampden.	Southbridge.	Wilbraham.
Holland.	Sturbridge.	

District No. 15.

Deputy Dennis F. Shea, Ware.

Telephone, 132.

Amherst.	Hadley.	Pelham.
Barre.	Hardwick.	Prescott.
Belchertown.	Leverett.	Shutesbury.
Dana.	New Braintree.	South Hadley.
Enfield.	New Salem.	Sunderland.
Granby.	Oakham.	Ware.
Greenwich.		

District No. 16.

Deputy James P. Hatch, Springfield.

Telephone, 2571–3.

Agawam.	Holyoke.	Springfield.
Blandford.	Longmeadow.	West Springfield.
Chesterfield.	Montgomery.	Westfield.
Chicopee.	Northampton.	Westhampton.
East Longmeadow.	Russell.	Williamsburg.
Easthampton.	Southampton.	
Granville.	Southwick.	

District No. 17.

Deputy Lyman E. Ruberg, Greenfield.

Telephone, 376–R.

Ashfield.	Erving.	Northfield.
Bernardston.	Gill.	Orange.
Buckland.	Greenfield.	Shelburne.
Colrain.	Hatfield.	Warwick.
Conway.	Leyden.	Wendell.
Deerfield.	Montague.	Whately.

District No. 18.

Deputy Arthur M. Nichols, North Adams.

Telephone, 391–12.

Adams.	Hawley.	Rowe.
Charlemont.	Heath.	Savoy.
Cheshire.	Monroe.	Williamstown.
Clarksburg.	New Ashford.	Windsor.
Florida.	North Adams.	
Hancock.	Plainfield.	

District No. 19.

Deputy Fred R. Zeigler, Pittsfield.

Telephone, 362–11.

Chester.	Huntington.	Peru.
Cummington.	Lanesborough.	Pittsfield.
Dalton.	Lee.	Richmond.
Goshen.	Lenox.	Washington.
Hinsdale.	Middlefield.	Worthington.

District No. 20.

Deputy DeWitt Smith, Great Barrington.

Telephone, 72–6.

Alford.	Mount Washington.	Stockbridge.
Becket.	New Marlborough.	Tolland.
Egremont.	Otis.	Tyringham.
Great Barrington.	Sandisfield.	West Stockbridge.
Monterey.	Sheffield.	

DISTRICT No. 21.

Deputy CHARLES L. SAVERY, West Tisbury.

Telephone, .

Chilmark.	Gay Head.	Tisbury.
Edgartown.	Oak Bluffs.	West Tisbury.

The districts should be organized with a competent assistant or subdeputy in each town.

The report of Chief Deputy Nixon follows: —

BOSTON, MASS., Jan. 1, 1910.

Commissioners on Fisheries and Game, State House, Boston, Mass.

GENTLEMEN: — I herewith submit my annual report as chief deputy for the year ending Dec. 31, 1909.

During the year I have devoted a large part of my time in the office to directing and supervising the work of the deputies in the field engaged in the enforcement of law. I have also assisted deputies at times in field work, and instructed them in work which was to be done, always having in mind the enforcement of the fish and game laws in a fair and impartial manner, with justice for all and malice toward none. The officers in charge of the execution of laws must enjoy the confidence of the people, because when information is given it is done in absolute confidence, and usually only after assurance is given that the informant will not be in any wise connected with the prosecution after such information is given. Then devolves upon this department the investigation, the securing of evidence, and the beginning of the prosecution if sufficient evidence can be secured. I am pleased to say that from indications in the past this office has enjoyed to a great extent the necessary co-operation of those who believed in a fair and impartial enforcement of the fish and game laws. During the year 231 complaints have been received at this office for violation of the fish and game laws, by coming in person to the office at 158 State House, by letters to the office and by telephone, all of which have been referred to the deputy in whose district they occurred, where the prompt investigations which have been made have resulted in a large number of arrests and convictions.

Automobiles. — The use of the automobile as a means of transportation to the hunting grounds has become very popular, and wide territories are covered by hunters who use them, with the result that birds are liable to be completely exterminated in covers to which the auto has easy access. The auto comes again into play as a means of escape for violators. It has been used to good advantage (to the vio-

lator) in cases of Sunday hunting, killing deer, shooting pheasants, etc., as wide territories may be rapidly covered. It is located with difficulty by the deputies, as the hunters work an hour or two in certain covers if violating the law, and then (for another hour) take the auto to fields anew, which may be miles from the last scene of operation. Thus it is wholly impossible for the deputies to follow, even when they know where the violators are to operate. Partridge, pheasant and deer have been shot illegally by this means, and the violators have escaped the penalty of the law.

Some Important Changes in Game Laws (Wild Fowl and Deer). — Many important changes were made in the game laws at the last session of the Legislature, noticeably in regard to wild fowl (chapter 421), which puts a close season on geese and brant for the first time in Massachusetts, and stops all spring shooting. Under the new deer law (chapter 396, Acts of 1909), which became operative June 14 of this year, allowing the owner of land which was under cultivation to shoot deer doing damage thereon, 198 deer have been shot and the meat used by persons shooting it, or given away by them to others for food; as compared with 16 in 1907 and 17 in 1908, when the meat was required to be sold and the money turned into the State treasury. Upon receipt at the office of notice of killing (the law provides that the person shall send to the office within twenty-four hours), the nearest deputy was notified to make a thorough investigation of the damage done and facts of such killing, and a report sent to this office. As a result of such investigations, four different parties have been put into court, under instructions from the office, for illegal killing of deer; two were found guilty and paid fines, one was found guilty and the case filed, and one was discharged.

In looking over the premises when damage was claimed to be done by deer, the deputies in nearly every case found damage which fully justified the killing under the present law. In one case the owner claimed damage done by the deer shot as the value of apples eaten, 15 cents. The deputy's estimate was 3 cents on the same case. Another case, the owner's estimate was 15 cents; deputy's estimate, 5 cents. The largest estimate of damage was $60, and was allowed by appraisers appointed by the chairman of the selectmen of the town.

The largest number of deer present at one time and doing damage when one of their number was shot was seven. The largest number of deer shot by one person at one and the same time while doing damage was three, one doe and two fawns. The largest number of deer shot by or under the orders of the same person since June 17, when the new law became operative, was three each by four different persons.

In some instances the deer were probably shot first, and the hoof marks made later, and there are "rumors" that damage done by woodchucks and rabbits was attributed to deer by the hoof-mark method. Salt was sometimes used for enticing the deer to destruction. The

number killed by farmers this year appears to be greatly in excess of that required.

The present law has caused a vast amount of criticism among the sportsmen, as they claim that it gives the farmer not only an open season, but a chance to shoot a deer at any time that he feels so inclined. The open season on deer should allow the shooting of one, and not confine the hunter to either sex, for the reason that if they are allowed to shoot their allotment they will return perfectly satisfied with their hunt after getting their deer. If the law makes it illegal to shoot does, I think a mistake will be made, for the reason that a person when hunting deer will shoot at the deer first, and find out what the sex is afterwards; and a good many does will be shot, and after the hunters find out their mistake they will either take chances in taking the deer in violation of law, or leave it to be destroyed. If they are allowed to shoot either sex, then they will be satisfied. I am of the opinion that a short open season with special deer license would bring a very substantial sum into the treasury of the Commonwealth. It would seem that something of this kind should be done to protect the State's interest, and to get some return for moneys expended by the State for damage done by deer and for the State moneys expended by this commission for the deer's protection. The argument is often raised that to have an open season on deer will cause the loss of a number of lives and many serious shooting accidents. This is a chance that all hunters and sportsmen take when they go into the woods with loaded firearms. An accident is liable to happen at any moment, no matter how careful the hunter may be; and in my opinion would not be any more liable to happen in hunting deer than it would in hunting other game. If a hunter is allowed to shoot his allotment of deer of either sex, he will get out of the covers sooner than if he is restricted to buck deer.

As the law stands to-day, a farmer not only can shoot a deer doing damage, no matter how little or insignificant, but can have the carcass for food and can also collect damage from the State in money value. If a farmer shoots deer doing damage and can have the deer carcass, then no money should be paid to him for damage done by the deer shot. In numerous instances when damage was done the past year to crops no claim was made, nor was any deer shot, the farmer being averse to taking advantage of the law by making claim for damages, or shooting, as they like to see the deer around.

Below is given a summary of deer killed, by counties, amount of damages, etc.; a comparison of deer shot doing damage the past three years under different laws; also a comparison of deer seen the past three years, reported by deputies and others. The estimate of damage is somewhat misleading, as in some cases it was almost impossible to give any estimate as to deer eating apples, eating buds and blossoms from fruit trees, tramping down millet, rye, rape, clover, corn and vegetables. In opening up the stomachs of deer, quantities of apples

and vegetables would be found. In some cases the owner would not, or could not, give any estimate, and the deputies have done the best they could. This problem of how to best protect the deer is becoming a very important one, and will need careful consideration in regard to future laws made concerning them.

Total Arrests for killing Deer illegally, 1909. — During the year just closed, 22 arrests were made by deputies for the illegal killing of deer in this Commonwealth. Of these cases, 20 convictions were secured, and $1,185 in fines were paid on 19 cases. One case was placed on file, and 2 discharged.

Summary of Deer killed under Chapter 396, Acts of 1909, since the Law went into Effect, June 14, 1909.

County.	Number killed.	Damage.	
		Owner's Estimate.	Deputy's Estimate.
Barnstable,	–	–	–
Berkshire,	20	$183 40	$89 78
Bristol,	–	–	–
Dukes,	–	–	–
Essex,	5	40 00	17 50
Franklin,	94	758 00	727 25
Hampshire,	20	98 50	57 00
Hampden,	27	210 98	103 58
Middlesex,	4	23 00	5 50
Norfolk,	2	–	–
Nantucket,	–	–	–
Plymouth,	2	45 00	25 00
Suffolk,	–	–	–
Worcester,	24	53 00	76 00
Total,	198	$1,411 88	$1,101 61

Money paid by the State Treasurer, according to Acts of 1903, Chapter 407, for Damage done by Wild Deer.

1903,	$237 30
1904,	392 25
1905,	1,117 05
1906,	2,822 73
1907,	2,912 78
1908,	4,370 03
1909,	7,923 09

Forest Fires. — Inasmuch as our deputies spend much of their time in the woods, assistance is frequently given in checking forest fires, and especially in arresting persons thus violating the State laws relative to setting fires. The following cases were reported: —

Deputy Bemis,	3
Deputy Burney,	1
Deputy Converse,	3
Deputy David,	8
Deputy Larkin,	3
Deputy Leonard,	2
Deputy Mills,	3
Deputy Ruberg,	1
Deputy Marks,	3
Deputy Shea,	1
Deputy Tribou,	2
Deputy Stratton,	2
Deputy Nichols,	1
Deputy Osborn,	8

Pheasants. — The pheasant, the game bird of Massachusetts in the future, is reported as multiplying in good shape and in excellent condition; and I think that when the commission decided to stock the covers of Massachusetts with this most popular game bird, they planned better than they knew. All the covers of Essex County, the starting-point in this work, to-day contain many hundred pheasants. This hardy bird has proved its ability to live through the most severe New England winters, and has multiplied wherever liberated, and, if it were left alone and not hunted for a few years, would spread over a large area. From every part of the State where these birds have been liberated come good reports of their multiplying and their ability to care for themselves.

A number of complaints have been made by farmers regarding the pheasants doing damage to growing crops, peas, corn, etc., but no serious damage was reported. In some cases pheasants were accused of doing damage which was not done by them. The pheasant, if the farmer only knew it, is a benefit to him, as they eat numerous bugs and insects which destroy crops, chiefly the gypsy and brown-tail moth, locust, etc. These they consume by the hundred daily. I think the new law, Acts of 1909, chapter 309, putting a close season on them, will be very beneficial, although a good many will in all probability be shot in violation of the law. Pheasant hunting is a very exciting sport when done legally with a good dog and gun, and will give any sportsman a good run for the bird.

Partridge. — From all reports in regard to the partridge, I think that they have come through the season fairly well, and that a goodly

number have been left over for the breeding season. In the absence of strong public sentiment against the sale of partridge, it is very difficult to secure convictions, for the reason that the law is easily evaded.

Quail. — Good reports are received from deputies in various parts of the State regarding the increase of the quail, notably from the Cape district. In various parts of the State there is an unwritten law that the quail shall not be shot, but left for breeding purposes; the sportsmen have lived up to it very well the past few seasons, and a good many covies have been left, and with a mild winter and proper care much good will result.

Rabbits. — Gray rabbits have from all reports increased during the past season, and are affording good sport to those hunters who like this kind. White "rabbits," or, more properly, hares (northern varying hare), are gradually disappearing. Foxes, gray rabbits and overshooting are believed to be the cause. A law should be passed making it unlawful to dig out rabbits after the dog has driven them into their burrows, as this kind of work will soon deplete the covers. In certain localities to-day good covers have been completely cleaned out by this method.

Squirrels. — A large increase of gray squirrels is reported all over the State, due no doubt to the close season. The law on gray squirrels should be changed so as to allow the owner of fruit trees and corn fields to shoot them when found in the act of doing damage to the same. Numerous complaints have been made to the office and to deputies in regard to damage done by squirrels to pears and corn, mainly to pears, when they go into the tree and destroy large quantities of pears by eating holes in them and taking out the seed, which seems to be the objective point. I have had experience at my home in Cambridge in the heart of the city. I have three pear trees in the yard, and during the month of September every morning at daybreak I could see two gray squirrels in the pear trees, and on going out could pick up from two to three quarts of pears which had been destroyed. I also know of instances where squirrels have gone into corn fields and have carried off whole ears of corn in large quantities. I have seen them at this work in West Gloucester, in 1907.

Lobsters. — In the enforcement of the lobster law for the past season 29 arrests were made, on which 28 convictions were secured, with 1 case discharged; fines amounting to $546 were imposed and paid. The minimum penalty was $5; the maximum, $75. One case, where a $45 fine was imposed, is still pending.

Four hundred illegal lobsters were returned to the water from which they were taken, after being seized by the deputies, in the above cases.

Feathers used for Millinery Purposes. — I have devoted considerable of my time to the enforcement of the law regarding the sale of illegal feathers used for millinery purposes, and I am pleased to report that

the dealers, dyers, cleaners and wearers who formerly handled and used these feathers have become aware of the fact that the law is to be enforced without fear or favor, and I find that all (with a very few exceptions) are in full sympathy with such enforcement. I have found in my visits to these places that all intend to live up to the letter of the law. I have always been treated in a courteous manner, whether I was there for the purpose of giving a warning or for more serious business. I have endeavored to stop the having in possession of these illegal feathers by a number of warnings, but when that method failed I took more severe measures by putting the parties into court, where they were convicted and fined. I find that the general public are in full sympathy with such enforcement and I have received information of much value at different times from persons who were interested in the work.

The display of the Massachusetts Audubon Society at the Boston 1915 Exhibit, from Nov. 1 to Dec. 11, 1909, in which were shown some of the feathers and birds (loaned to the society by this commission) upon which convictions were secured and fines paid, attracted considerable attention, and was very instructive to the ladies and others who were interested in the law enforcement.

I was at the exhibit each night, and gave to the public all information desired as to which birds and feathers were in violation of the law, and which were not.

Power Boats. — Chapter 328, Acts of 1909, should be more clearly defined in relation to the pursuit of water fowl by power boats.

The number of power boats is rapidly increasing and the temptation to hunt from them is very strong, as no labor is required in getting to the hunting grounds along the shore and out in the bays. The law should be changed so as to allow the shooting of wild fowl from motor boats while at anchor, but not when under power, nor should they be allowed to pursue birds of any kind when the boat is under power. Considerable violation is being done by power boats hunting, pursuing and killing wild fowl in various waters along the shores in Massachusetts, and it is a very hard matter for the deputy to catch them. In order to do so the deputy is compelled to hire another boat, which sometimes is rather a hard proposition, as the owner will not consent if he knows for what purpose the boat is to be used. I would say, however, that deputies have at times found sportsmen who have not only been willing to let their boats, but have even assisted the deputy in making the arrest.

A good many violators use high-speed boats, and cannot be caught by a boat of ordinary speed. In some cases they use a boat with speed as high as 20 miles an hour.

Hunting Licenses. — The certificate of registration of all hunters should be confiscated by the court upon conviction of a violation of the act, and given to the deputies who make the arrest, to be immediately

forwarded to this office and placed on file. If the certificate is not taken away, the convicted person could use it indefinitely and show it on demand to any officer or other person who did not know it was void.

No person should be allowed to hunt without a license. Farmers, land owners and all should be included. If the farmers feel that they should be given special privileges, then give them the license free, or for the recording fee of 15 cents, but compel all to have a license. When deputies meet a hunter in the covers, and ask to see the license, and the hunter claims to be the owner of the land and does not require one, it is impossible to detect an impostor except by a very rare chance. If he is acquainted with the locality, and perhaps knows the person, then the matter is easily looked up. If, on the other hand, he does not know the locality, or the parties or owner, what is he to do?

Similarly, many hunters found in the covers, when approached by the deputy and asked to show the license, evade the law by claiming to be hunting foxes, woodchuck, crows and various other animals, or birds which are not protected, and for which no license is required unless the hunter is a nonresident or alien. If the law were changed so as to include all birds and animals, this prolific source of evasion could be very easily stopped. The act should also be changed so as to make it compulsory that the certificate be carried on the person when hunting.

I am of the opinion that no duplicate certificates should be issued, and I think it would be in violation of law to issue them. If a certificate is lost or destroyed, that should be a matter for the party to whom it was issued to be responsible for, and not the State. I think the fee should be changed so as to make it $1.15, so that the State could get the $1, and the clerk issuing it the 15 cents, as they are put to some expense for postage, stationery, etc. This would greatly assist the State Treasurer, by avoiding the necessity of drawing checks for trivial amounts, and would avoid the delay incidental to the return of the fee to the town clerks.

Numerous complaints have been made to the office regarding persons hunting without licenses, all of which have been investigated, and in some cases arrests have been made. In most cases it was too late for the deputies to locate the violators.

Acting under instructions from this office, the paid deputies have sent in since September 21 the registered number of 1,004 certificates of hunters whom they have met on the hunting grounds and looked over for illegal game.

The total number of different offences committed by violators was 51, of which one was for interfering with a deputy in the discharge of his duty; this offender was arrested, convicted, and paid $30. Another was for assault on a deputy; and the offender was arrested, convicted and fined $10, together with a fine of $25 for hunting without a license, making a total of $35, which was paid.

The number of persons arrested for violation of Acts of 1909, chapter 325 (violation of act requiring the registration of hunters), since Jan. 1, 1909, was 23. The details and summaries are given on another page.

The assignment of deputies to definite districts and the publication of the districts in the fish and game laws was, I think, a step in the right direction, as it put the public in a position to report violations to deputies at short notice, with resulting quick service and sometimes the catching of violators in the act.

Deputies should be brought more under the control of the office, and not allowed to go into each other's districts, thus adding additional expense to the State without good reason therefor. Each deputy is given to understand that he must be as economical as possible in the expenditure of all moneys which are to be charged up to the State, from whose treasury comes his wages and expenses. It is important that it should be firmly impressed on the mind of every deputy that the best work with the least possible expenditure of public money will bring to him and to this commission the hearty co-operation of all.

Criticism of the methods of work of the deputies is gladly welcomed, as is also any suggestion for the enforcement or betterment of the work done by them, as only in this way can an efficient force be maintained and the best results accomplished.

I wish at this time to speak a good word for the deputies and for the work which they have to do. A large majority of them are honest, capable, faithful, conscientious and willing public servants. The life of a deputy is not one grand, sweet song. At times he has to stand a lot of criticism concerning the methods of work of himself and the commission, which is often unjust. The deputies of this department, unlike most other employees of this Commonwealth, do not have an eight-hour schedule, but give their entire time, if necessary, to the work which they have to do. I know of numerous instances when the deputies have worked out in the coldest weather the entire twenty-four hours, without sleep. They work all Sundays and holidays, as well as every day of the week; generally the hardest work brings the least results. A deputy must have good common sense, sound judgment, and be quick to act on things as he finds them; sometimes the most important matters must be decided in an instant, and be decided in the right way. I think the deputies of this commission will compare favorably with any body of men similarly employed anywhere in the United States.

Much credit should be given to the various police officials, police officers, constables and all officers who have during the past year assisted the various deputies in the work which they had to do; also to the clerks of the several courts, for their assistance and help to the deputies; and more especially to the judges of the courts of the Commonwealth, for their fairness and the judicial manner in which they have disposed of the various cases for violation of the fish and game laws,

always having in mind their duty to the Commonwealth and the right of the defendant. As the enforcement of the fish and game laws lies largely with the court, the decisions rendered educate and enlighten the public, which is most vitally interested, and without whose assistance and co-operation no law can be upheld. I think the general public and the law-abiding sportsman are in full sympathy with the commission for a full and impartial enforcement of the fish and game laws.

Certain unpaid deputies should be commended for the good work done by them the past year. This work was not done for *what was in it,* but for the good of the cause and a wish to see the law upheld, and was done in some cases at a financial loss to the deputies.

Respectfully submitted,

WILLIAM W. NIXON, *Chief Deputy.*

Classification of Arrests during the Year 1909.

Form of Violation.	Number of Counts.
Shellfish from polluted waters,	77
Hunting on Lord's Day,	54
Aliens hunting without license,	33
Residents hunting without license,	20
Possession of and hunting with ferret,	4
Shooting pheasant,	4
Using over ten hooks on ponds, etc.,	3
Possession of seed scallops,	1
Killing or possession of gray squirrels,	20
Hunting, wounding or killing deer,	22
Shooting gulls or terns,	4
Setting traps or snares,	4
Interfering with officer,	1
Possession of smelts in close season,	10
Taking smelts with net,	7
Taking trout in close season,	2
Possession of pickerel under ten inches,	6
Taking fresh-water fish with net,	10
Possession of short lobsters,	23
Killing song or insectivorous birds,	11
Possession of short trout,	15
Killing fish by dynamiting waters,	2
Fishing in closed ponds,	5
Using over one hook on stocked pond,	4
Destroying or taking eggs of wild birds protected by law,	6

Classification of Arrests during the Year 1909. — Con.

Form of Violation.	Number of Counts.
Possession of short bass,	8
Having egg-bearing lobsters for sale,	4
Mutilating lobsters,	1
Torching herring,	11
Having unmarked lobster car,	1
Spearing fish,	5
Larceny of lobsters,	1
Pursuing wild fowl with power boat,	3
Assault with dangerous weapon,	1
Nonresidents hunting without license,	5
Possession of ruffed grouse in close season,	2
Residents refusing to show license,	3
Killing rabbits in close season,	4
Killing wood duck,	1
Using seine of less than five-inch mesh,	5
Maintaining fish trap without permit,	1
Pursuing ducks in Great Pond, Edgartown,	1
Dogs chasing deer,	3
Possession of prohibited feathers for millinery,	7
Possession of black ducks in close season,	1
Seining pond,	1
Total,	417

Comparative Table of Law Enforcement, 1908–09.

	1908.	*1909.*
Total fines imposed,	$7,097 50	$5,804 50
Fines from arrests by paid deputies,	6,348 50	5,400 50
Fines from arrests by unpaid deputies,	759 00	404 00
Total number counts taken to court,	472	417
Total number persons arrested,	455	383
Convictions,	424	397
Discharged,	45	19
Defaulted,	2	1
Cases filed,	77	59

Of two cases appealed in 1908, not included in above, one paid $20 and the other $53. One lobster case, fine $45, appealed in 1909, still pending.

Itemized List of Moneys received by the Commissioners on Fisheries and Game during the Year 1909 and paid to the Treasurer and Receiver-General.

Received for —	Amount.
Issuance of nonresident hunters' licenses (chapter 198, Acts 1907, as amended by chapter 262, Acts of 1909).	$988 20
Heath hen fund (chapter 504, Acts of 1907),	100 00
Sale of egg-bearing lobsters to United States Bureau of Fisheries stations,	672 25
Sale of deer carcasses (chapter 377, Acts of 1908),	38 50
Interest on deposits in bank,	29
Total,	$1,799 24

There have been no applications for the inspection of fish under the Acts of 1902, chapter 138, and no fees have been received.

Under the Acts of 1907, chapter 198, as amended by chapter 262, Acts of 1909, this commission, which issues licenses to nonresidents, has granted licenses as follows: —

1907,	81 licenses, at $10 each,	$810 00
	18 licenses, at $1 each,	18 00
1908,	46 licenses, at $10 each,	460 00
	21 licenses, at $1 each,	21 00
1909,[1]	92 licenses, at $10 each,	920 00
	68 licenses, at $1 each,	68 00
Total,		$2,297 00

Recommendations for Legislation.

We respectfully recommend the passage of laws designed to accomplish the following purposes: —

1. That investigation be made of the infectious diseases of native birds and of foreign birds introduced into the State, with

[1] In addition to the issue of $10 licenses for 1909, as here given, we issued 5 licenses as exchanges, 2 for licenses paid for in 1908 and not used, 3 in exchange for licenses issued in error by town clerks and money paid by them into State treasury.

a report including expert opinions upon the probability of such diseases spreading among our native birds, and, so far as possible, suggesting remedies and methods for preventing such infection; and that for these purposes money be appropriated from money received by the Commonwealth for hunting licenses.

2. That a biological investigation and report be made upon the adaptability of the public waters of the State for rearing food fishes, to devise methods and to determine as nearly as possible the quantity of fish which various waters are capable of producing annually and to ascertain the best methods of stocking such waters; and that an appropriation not exceeding $2,000 a year for three years be appropriated for this purpose.

3. That the laws relative to shooting from boats propelled by mechanical means other than oars should be so defined as to make plain their meaning relative to power boats when not under power.

4. That the commission should have authority to purchase, lease or receive as a gift lands to be used as bird reservations, *i.e.*, specially protected breeding places for birds. Property thus acquired should become the property of the Commonwealth, to be administered by the Commissioners on Fisheries and Game, for the purpose of securing the utmost possible population of useful birds. Whenever necessary to confirm titles, power of eminent domain should be given similar to that in chapter 504, Acts of 1907; and that of the money received by the Commonwealth for hunters' licenses a sum not exceeding $5,000 annually may be expended for the purpose of acquiring land for such purposes.

5. That to secure more satisfactory enforcement of the laws the legal measurement of lobsters should be made upon the shell (carapace), exclusive of the tail; and that this legal measure of length should be 4¾ inches, in conformity with the law of Maine.

6. That all lobster fishermen, dealers and all persons catching or transporting lobsters within this Commonwealth should be licensed.

7. That all lobsters or parts of lobsters sold for use in this State or for export therefrom must be sold and delivered in the shell.

8. We renew our recommendations of last year for more adequate and economical facilities for propagating and distributing food fish and useful birds.

9. Also, for such amendment of the laws as to ensure the development of the mollusk fisheries below high-water mark in such a manner as to permit increase in the economic yield of food material; to furnish wider opportunities for remunerative employment of skilled and unskilled labor.

10. The laws relative to deer should be amended so as to permit a short open season, under suitable restrictions.

11. Dogs should not be allowed to run at large during the breeding season of birds in areas frequented by them, from March first to October first.

12. Special investigations should be made to determine how those birds which feed upon gypsy and brown-tail moths, leopard moths, cut worms and other noxious insects, can be increased or colonized within the infected regions or in special locations.

13. Some decision should be made relative to the issuance of duplicate licenses under Acts of 1907, chapter 198, as amended by Acts of 1909, chapter 262, and Acts of 1908, chapter 484, as amended by Acts of 1909, chapter 325.

Also, under same acts, the persons applying for a license should be required to establish their identity; and for the purpose of permitting effective enforcement the requirements for license or registration should be extended to all persons hunting for any species of bird or mammal, and further require that the license or certificate of registration should be carried on the person when hunting.

Minors under sixteen years of age making application for registration should be obliged to have the consent of their parents or guardian in writing.

Upon conviction of violation of game laws, persons holding licenses should be instructed by the court convicting them to surrender such license to the deputy who secures the conviction, and that said license shall then be sent to the office of the commission.

14. Many complaints have arisen relative to damage done to crops and to other property by gray squirrels. Some pro-

vision should be made for reimbursement by the State; or else a short open season, with a "bag limit," should be permitted in those sections where damage is most frequent.

15. The protection of upland plover expires by limitation July 15, 1910. We recommend that this be extended until July 15, 1915.

16. Section 12 of chapter 92 of the Revised Laws, as amended by Acts of 1906, chapter 278, should be further amended to coincide with date of the open season on hares and rabbits.

17. Chapter 285, Acts of 1907, which permits the taking of clams and quahaugs from contaminated waters, should be repealed.

18. Depositing shavings, garbage, ashes, acids, dye stuffs and other waste materials, which may directly or indirectly injure the economic value of public waters, should be prohibited.

19. On petition of the mayor and aldermen of a city or of the selectmen of a town within which a great pond or any portion thereof is situated, the Commissioners on Fisheries and Game, subject to the approval of the Governor and Council, may prescribe such reasonable regulations relative to the fishing in such ponds and their tributaries, with such penalties, not exceeding $20 for one offence, as they deem to be for the public interest, and shall cause such regulations to be enforced.

20. The deputies of this commission should be authorized to arrest hunters whom they find in the act of tearing down walls, destroying fences, cutting trees or injuring or destroying other property.

21. That chapter 367, section 1, Acts of 1904, be amended so as to allow the commissioners or their deputies or other officers to search in certain places for game or fish without a warrant.

Courtesies.

It is a pleasure again to acknowledge the assistance so courteously rendered to the commission by Mr. Arthur L. Millett, local agent of the United States Bureau of Fisheries at Gloucester, and by Mr. F. F. Dimick, the efficient secretary of the Boston Fish Bureau, in furnishing statistics and special information relating to the marine fisheries.

Permits to hold egg-bearing lobsters in confinement, for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 553 fishermen and dealers.

Permits for taking birds and eggs under section 9, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following-named persons: —

Albert H. Tuttle, Cambridge.
Frederick H. Carpenter, Seekonk.
B. G. Willard, Millis.
John H. Hardy, Jr., Boston.
Clarence Birdseye, Amherst.
Frederick H. Kennard, Boston.
Chester S. Day, West Roxbury.
Chester A. Reed, Worcester.
Arthur F. Gilbert, New Bedford.
Robert O. Morris, Springfield.
Fred B. McKechnie, Boston.
George M. Gray, Woods Hole.
William Dearden, Springfield.
J. A. Barton, Fitchburg.
A. C. Bent, Taunton.
Nathan F. Stone, Shrewsbury.
Owen Durfee, Fall River.
William Brewster, Cambridge.
James P. Porter, Worcester.
Frank S. Akin, Fall River.
Haynes H. Chilson, Northampton.
Charles R. Lamb, Boston.
Edward R. Adams, Canton.
Henry P. Burt, New Bedford.
F. A. Binford, Hyannis.
R. H. Carr, Brockton.
Frank Blake Webster, Hyde Park.

Permits to have wild ducks in possession, for purposes of propagation, were issued to: —

Seth A. Borden, Fall River.
Alfred V. Freeman, South Duxbury.
J. Goulding, South Sudbury.
Bayard Thayer, Lancaster.
Thos. S. Plummer, Dartmouth.
Spencer Borden, Fall River.
James E. Rothwell, Brookline.
Guilford C. Hathaway and Benjamin W. Brown, Fall River.
Allan Keniston, Edgartown.
H. S. Little, Newbury.
Frederick E. Mosher, New Bedford.
Wm. H. Thurston, Plymouth.

Permits to have wild Canada geese in possession, for purposes of propagation, were issued to: —

H. S. Little, Newbury.
James E. Rothwell, Brookline.

Permit to have native insectivorous birds in possession, to be used in connection with experiments and observations upon the use of birds for destroying certain flies in greenhouses, was issued to: —

Seth A. Borden, Fall River.

Permits to bring into the Commonwealth during the close season not exceeding 50 birds known as Anatidæ, in accordance

with the provisions of Acts of 1909, chapter 421, section 2, were issued to: —

H. B. Endicott, Boston.
Thomas S. Silsbee, Boston.
H. Wendell Endicott, Dedham.
Eben C. Norton, Norwood.
James M. Codman, Brookline.
Thomas Barbour, Brookline.
Henry E. Bigelow, Cambridge.
John N. Beebee, Boston.
Decim Beebee, Boston.
F. S. Mead, Brookline.
Frank B. Bemis, Boston.
Wilton Lockwood, Boston.
Arthur N. Milliken, Boston.
John B. Paine, Weston.
Charles Merriam, Weston.
G. F. Blake, Weston.
Charles J. Paine, Weston.
Dr. B. Vincent, Boston.
J. D. Upton, Boston.
Paul Windsor, Weston.
Wm. H. Slocum, Boston.

Permits to have quail in possession, for purposes of propagation, were issued to: —

Clarence M. Snow, Provincetown.
Edmond L. Sinnott, Bridgewater.
J. Goulding, South Sudbury.
Spencer Borden, Fall River.
C. F. Hodge, Worcester.
James H. Porter, Worcester.

Permits to have ruffed grouse in possession, for purposes of propagation, were issued to: —

C. F. Hodge, Worcester.
James P. Porter, Worcester.

Permit to have native insectivorous birds in possession for purposes of observation, was issued to: —

James P. Porter, Worcester.

Permit to have northern varying or white hares in possession, for purposes of propagation, was issued to: —

Fish and Game Protective Association, Brockton.

Permits to rear and sell pheasants, in accordance with the provisions of Acts of 1909, chapter 309, were issued to: —

Howard E. Newton, Foxborough.
Thomas R. Sherburne, Lexington.
Frederick W. Fisher, Newton.
Albert L. Brown, Cohasset.
Andrew S. Coyle, Taunton.
Minnie Blagden, Rowley.
H. S. Little, Newbury.
Austin L. Millett, Rowley.
Milan A. Brayton, Fall River.
Grenville Lindall Winthrop, Lenox.
Charles M. Emerson, Taunton.
Edward C. Alden, Taunton.
C. L. Converse, Stoneham.
Elmer A. Macker, North Grafton.
James Ashton, Fall River.
A. N. Reynolds, Westwood.
Chester H. Keyes, Middleborough.
E. H. Allen, Stoneham.
S. B. S. Keyes, Middleborough.
Frank R. Boston, Beverly.
G. Marston Whitin, Whitinsville.
John Clark, Brockton.
J. Goulding, South Sudbury.
George M. Ballard, Danvers.
Charles F. Berry, Needham Heights.
Bayard Thayer, Lancaster.
E. P. Wilbur, South Framingham.
Seth A. Borden, Fall River.
John C. Phillips, Boston.
M. J. McQuaid, Clinton.
Spencer Borden, Fall River.
Frederick E. Mosher, New Bedford.
James E. Rothwell, Brookline.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to the following persons: —

Elmer A. Durgin, Rowley.
A. P. Hilton, Newburyport.

Permit to have lobsters of any size in possession, for scientific purposes, was issued to: —

Marine Biological Laboratory, Woods Hole.

Permit to transfer spawning white perch and pickerel to a satisfactory spawning ground was issued to: —

Charles E. Tribou, Brockton.

Permit to take smelts during close season, for the purpose of ascertaining facts regarding breeding habits, was issued to: —

William W. Nixon, Somerville.

Permit to take trout from the waters controlled by the town of Mashpee, for purposes of propagation, was issued to: —

Frank E. Hitchings, Sandwich.

Permit to have live brook trout of less than legal length in possession, for purposes of study, was issued to: —

Lester F. Potter, New Bedford.

Permits to use a seine in the waters of Pleasant Lake, lying between Harwich and Brewster, and in the ponds in Barnstable County, for securing white perch for scientific purposes, were issued to: —

Everett B. Mecarta, Harwich.

Permits to buy and sell or have in possession trout artificially propagated and maintained, in accordance with the provisions of Acts of 1909, chapter 377, were issued to: —

Sandwich Trout Company, Sandwich.
A. R. Graham & Son, Berkley.
A. B. Savery, Wareham.
Jacob Diegel, Agawam.
Estate of Walter L. Gilbert, Chas. S. Davis, trustee, Plymouth.
Plymouth Rock Trout Company, Plymouth.
H. F. Hurlbut, East Freetown.
N. F. Hoxie, Plymouth.
William A. Gaston, Barre.
Charles R. Doten, Plymouth.

Respectfully submitted,

GEORGE W. FIELD,
JOHN W. DELANO,
GEORGE H. GARFIELD,
Commissioners.

APPENDICES.

[A.]

List of Commissioners.

United States Bureau of Fisheries, Washington, D. C.

George M. Bowers, Commissioner.

Hugh M. Smith, Deputy Commissioner.

Irving H. Dunlap, Chief Clerk.

R. S. Johnson, Assistant in charge of Division of Fish Culture.

Barton W. Everman, Assistant in Charge of Division of Inquiry Respecting Food Fishes.

A. B. Alexander, Assistant in Charge of Division of Statistics and Methods.

Hector Von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.

Charles G. Atkins, Craig Brook, East Orland, Me.

E. E. Hahn, Boothbay Harbor, Me.

W. F. Hubbard, Nashua, N. H.

E. N. Carter, St. Johnsbury, Vt.

C. G. Corliss, Gloucester, Mass.

E. F. Locke, Woods Hole, Mass.

Chester K. Green, Cape Vincent, N. Y.

L. G. Harron, Washington, D. C.

George A. Seagle, Wytheville, Va.

R. K. Robinson, White Sulphur Springs, W. Va.

H. D. Aller, Beaufort, N. C.

J. J. Stranahan, Cold Springs, Bullochville, Ga.

James A. Henshall, Tupelo, Miss.

W. E. Morgan, Edenton, N. C.

A. G. Keesecker, Fishery, Tenn.

S. W. Downing, Put-in-Bay, O.

Frank N. Clark, Northville, Mich.

S. P. Wires, Duluth, Minn.

S. P. Bartlett, Quincy, Ill.

M. F. Stapleton, Manchester, Ia.

W. O. Buck, Neosho, Mo.

J. L. Leary, San Marcos, Tex.

W. T. Thompson, Leadville, Col.

D. C. Booth, Spearfish, S. D.

H. D. Dean, Bozeman, Mont.
G. H. Lambson, Baird, Cal.
Henry O'Malley, Clackamas, Ore.
A. H. Dinsmore, Baker Lake, Wash.
W. K. Hancock, Yos Lake, Alaska.
M. F. Stapleton, Mammoth Spring, Ark.
C. P. Henkle, Afognak, Alaska.
R. E. Coker, Fairport, Ia.

Alabama.

Game and Fish Commissioner.

John H. Wallace, Jr., ... Montgomery.

Arizona.

Fish and Game.

T. S. Bunch, ... Safford.
W. L. Pinney, Secretary, ... Phœnix.
E. A. Sliker, ... Flagstaff.

California.

George Stone, President, ... San Francisco.
F. W. VanSicklen, ... Alameda.
M. J. Connell, ... Los Angeles.
Charles A. Vogelsang, Chief Deputy, . . . San Francisco.

Colorado.

Thomas J. Holland, Commissioner, . . . Denver.
R. L. Spargur, Chief Clerk, ... Denver.
W. E. Patrick, Superintendent Fish Hatcheries, . Denver.
James A. Shinn, Deputy Commissioner, . . Denver

Connecticut.

George T. Mathewson, President, ... Thompsonville.
E. Hart Geer, Secretary, ... Hadlyme.
E. Hart Fenn, ... Wethersfield.

Delaware.

Game Protective Association.

A. D. Poole, President, ... Wilmington.
E. G. Bradford, Jr., Secretary and Treasurer, . Wilmington.

Florida.

Honorary Fish Commissioner.

John Y. Detwiler, ... New Smyrna.

GEORGIA.

Fish Commissioner.

A. T. Dallis, ... LaGrange.

IDAHO.

Fish and Game Warden.

William N. Stephens, State Game Warden, . . Boisé.
B. T. Livingston, Chief Deputy, ... Boisé.

ILLINOIS.

State Game Commissioner.

John A. Wheeler, ... Springfield.

Board of Fish Commissioners.

Nat H. Cohen, President, ... Urbana.
S. P. Bartlett, Secretary, ... Quincy.
Henry Kleine, ... Chicago.

INDIANA.

Z. T. Sweeney, Commissioner, ... Columbus.
E. E. Earle, Chief Deputy, ... Indianapolis.

IOWA.

Fish and Game Warden.

George A. Lincoln, ... Cedar Rapids.

KANSAS.

L. L. Dyche, ... Lawrence.

MAINE.

Inland Fisheries and Game.

J. W. Brackett, Chairman, ... Phillips.
L. T. Carleton, ... Winthrop.
Edgar F. Ring, ... Orono.

Sea and Shore Fisheries.

James Donahue, Commissioner, ... Rockland.

MARYLAND.

Fisheries Commissioners.

Samuel J. Twilley, ... Worcester County.
Dr. Herbert J. Wade, ... Washington County.

Game Warden.

H. F. Harmonson, ... Berlin.

MASSACHUSETTS.

Commissioners on Fisheries and Game.

George W. Field, Chairman, ... Boston.
John W. Delano, ... Marion.
George H. Garfield, ... Brockton.

MICHIGAN.

Fish Commissioners.

Charles D. Joslyn, President, ... Detroit.
Delbert H. Power, Vice-President, ... Sutton's Bay.
Fred. Postal, ... Detroit.

State, Game, Fish and Forestry Warden.

Charles S. Pierce, ... Lansing.
Charles N. Smith, Chief Deputy, ... Petoskey.

MINNESOTA.

Game and Fish Commissioners.

Robert Hannah, President, ... Fergus Falls.
George J. Bradley, First Vice-President, . . Norwood.
O. J. Johnson, Second Vice-President, . . . Glenwood.
Joseph A. Wessel, Secretary, ... Crookston.
H. A. Rider, Executive Agent, ... Little Falls.

MISSOURI.

Fish Commissioners.

L. A. Geserich, President, ... St. Louis.
T. N. McHaney, Vice-President, ... Kennett.
W. S. Willard, Secretary, ... St. Joseph.
Ed. Willoughby, ... Windsor.
Richard Porter, ... Paris.

State Game and Fish Commissioner.

Jesse A. Tolerton, ... Jefferson City.

MONTANA.

State Game and Fish Warden.

Henry Avare, ... Helena.
D. H. Morgan, Deputy, ... Helena.

Nebraska.

Gov. A. C. Shallenberger, Commissioner ex officio,	Lincoln.
Dan Geilus, Chief Deputy,	Lincoln.
W. J. O'Brien, Superintendent of Hatcheries,	Gretna.

Nevada.

Fish Commission.

George T. Mills,	Carson.
E. B. Yerington,	Carson.
James Clark,	Reno.

New Hampshire.

Nathaniel Wentworth, Chairman,	Hudson Centre.
Charles B. Clarke,	Concord.
Frank P. Brown,	Whitefield.

New Jersey.

B. C. Kuser, President,	Trenton.
William A. Logue, Treasurer,	Bridgeton.
Percival Christie,	High Bridge.
Ernest Napier,	East Orange.
Walter H. Fell, Secretary,	Trenton.

New Mexico.

Game and Fish Warden.

Thomas P. Gable, Territorial Game and Fish Warden,	Santa Fé.
Willis G. Fischer, Chief Deputy Game and Fish Warden,	Santa Fé.

New York.

Forest, Fish and Game Commission, Capitol, Albany, N. Y.

James S. Whipple, Commissioner,	Salamanca.
J. Duncan Lawrence, Deputy,	Bloomville.
John D. Whish, Secretary,	Albany.

State Superintendent of Marine Fisheries.

B. Frank Wood,	New York.

North Carolina.

Dr. R. H. Lewis,	Raleigh.
T. Gilbert Pearson,	Greensboro.

North Dakota.

District Game Warden.

W. N. Smith, District No. 1,	Grafton.
Olaf Bjorke, District No. 2,	Abercrombie.

Ohio.

Commissioners of Fish and Game.

Paul North, President,	Cleveland.
Thomas B. Paxton,	Cincinnati.
J. F. Rankin,	South Charleston.
D. W. Greene,	Dayton.
George W. McCook,	Steubenville.
George C. Blankner, Secretary,	Columbus.
J. C. Speaks, Chief Warden,	Columbus.

Oklahoma.

State Game and Fish Warden.

J. S. Askew,	Chickasha.

Oregon.

Master Fish Warden.

H. C. McAllister,	Portland.

State Game and Forestry Warden.

R. O. Stevenson,	Forest Grove.

Pennsylvania.

Game Commissioners.

James H. Worden, President,	Harrisburg.
C. K. Sober,	Lewisburg.
Charles B. Penrose,	Philadelphia.
John M. Phillips,	Pittsburg.
Arthur Chapman,	Doylestown.
Dr. Joseph Kalbfus, Secretary,	Harrisburg.

Department of Fisheries.

W. E. Meehan, Commissioner of Fisheries,	Harrisburg.

Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phœnixville.
W. A. Leisenring,	Mauch Chunk.

Rhode Island.

Commissioners of Inland Fisheries.

Charles W. Willard, President, ...	Westerly.
William P. Morton, Secretary, ...	Providence.
Adelbert D. Roberts, ...	Woonsocket.
William H. Boardman, ...	Central Falls.

Commissioners of Shellfisheries.

Philip H. Wilbour, Chairman, ...	Little Compton.
John H. Northup, ...	Apponaug.
Edward Atchison, ...	Slatersville.
Samuel F. Bowden, ...	Barrington.
John G. Wilcox, ...	Westerly.

Commissioners of Birds.

C. H. Remington, Chairman, ...	East Providence.
W. Gordon Reed, 2d, ...	Cowesset.
E. R. Lewis, ...	Westerly.
William H. Thayer, ...	Bristol.
A. O'D. Taylor, ...	Newport.

Tennessee.

State Warden.

Joseph H. Acklen, ...	Nashville.

Texas.

Game, Fish, and Oyster Commission.

R. H. Wood, ...	Rockport.

Utah.

Fred W. Chambers, ...	Salt Lake City.

Vermont.

H. G. Thomas, ...	Stowe.

Virginia.

Board of Fisheries.

W. McDonald Lee, Commissioner of Fisheries, .	Irvington.
S. Wilkins Matthews, Secretary, ...	Oak Hall.
George B. Keezell, ...	Keezletown.
Bland Massie, ...	Tyro.
J. Murray Hooker, ...	Stuart.
Edward L. C. Scott, Clerk, ...	Richmond.

Washington.

Fish Commissioner and Game Warden Ex Officio.

John L. Riseland, ... Bellingham.

West Virginia.

Game and Fish Warden.

James H. Marcum, ... Huntington.

Special Deputy.

F. H. Merrick, ... Huntington.

Wisconsin.

Department for the Protection of Fish and Game.

G. W. Rickeman, State Warden, ... Madison.
J. F. Sugden, Chief Deputy, ... Madison.

Commissioners of Fisheries.

The Governor, ex officio.
Calvert Spensley, President, ... Mineral Point.
James J. Hogan, Vice-President, ... LaCrosse.
E. A. Birge, Secretary, ... Madison.
William J. Starr, ... Eau Claire.
George B. Hudnall, ... Superior.
Jabe Alford, ... Madison.
A. A. Dye, ... Madison.
James Nevin, Superintendent, ... Madison.

Wyoming.

State Game Warden.

D. C. Nowlin, ... Lander.

[B.]

Distribution of Food Fish.

Trout Fry.

Distribution of Trout Fry from the Adams Hatchery during April and May, 1909.

Applicant.	Town.	Name of Brook.	Number.
James M. Burns,	Pittsfield,	Shaker,	5,000
William N. Jones,	Lanesborough,	Laurel Hill,	5,000
William H. Newton,	Pittsfield,	Daniels,	5,000
Joseph Ward Lewis,	Lanesborough,	Hollow,	5,000
Allen H. Bagg,	Lanesborough,	Wells,	5,000
Edwin T. Smith,	Lanesborough,	Sachem,	5,000
Arthur H. Wood,	Lanesborough,	Rice,	5,000
Dr. A. L. Boudreau,	– – –	– – – –	5,000
John McCormick,	Windsor,	McCormick,	5,000
Fred Harris,	Savoy,	Tanny,	5,000
D. E. Burnett,	Savoy,	Gulf,	5,000
George E. Safford,	– – –	– – – –	5,000
Robert Groves,	Savoy,	Bear,	5,000
J. E. Morgan,	Adams,	Tophet,	5,000
Harry J. Sheldon,	Cheshire,	Bassett,	5,000
George F. Sayles,	Adams,	Dry,	5,000
C. J. Fales,	Cheshire,	Fales,	5,000
George McAuley,	Adams,	Mason,	5,000
William P. Martin,	Cheshire,	Chapman,	10,000
Humphrey J. Coughlin,	Clarksburg,	North Branch, Sherman,	20,000
President Anglers' Club,	North Adams,	Tunnell, Hudson,	
J. M. VanHuyck,	Lee,	Mud Pond, Barlow,	10,000
Bradley C. Newell,	Rowe,	Newell,	5,000
Nelson M. Otis,	Chester,	Knox,	5,000
C. L. Haughton,			
Robert C. Hollister,			
F. H. Saunders,		Powder Mill,	
Leon H. Bowers,		Munn's,	
Edward G. Clark,	Westfield,	Timber Swamp,	50,000
James B. Hanks,		Oak Orchard,	
Edward L. Douglass,		Hundred Acre,	
Ralph L. Conner,		Jack's,	
Charles H. Gehle,			
George F. Gehle,			
			190,000

Fry distributed from the Hadley Hatchery during April, 1909.

Fred E. Field,	Montague,	Coldbrook,	10,000
R. L. Clapp,	Montague,	Pond,	10,000
George H. Thompson,	New Salem,	Middle Branch Swift River,	10,000
Greenfield Sportsman's Club,	Greenfield,	Green River,	25,000
L. W. Pettingill,	Cummington,	Mitchell,	10,000
W. S. Gabb,	Cummington,	Nipping,	10,000
W. G. Bisbee,	Williamsburg,	Hill,	5,000
Fred LaValley,	Williamsburg,	Bullard,	5,000

Fry distributed from the Hadley Hatchery, etc. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
F. E. Hawks,	Goshen,	Packard,	5,000
M. W. Smith,	Goshen,	Rogers,	5,000
W. A. Smith,	Goshen,	Hampshire,	5,000
John Doherty,	Goshen,	Highland,	5,000
A. D. Prouty,	Springfield,	Bliss,	20,000
P. M. Taylor,	Longmeadow,	Entry Dingle,	10,000
H. A. Buzzell,	Longmeadow,	Entry Dingle,	10,000
Charles S. Ballard,	- - -	Scantic,	10,000
			155,000

Fry distributed from the Sutton Hatchery during April and May, 1909.

T. B. Stevenson,	- - -	- - - -	5,000
C. A. Reynolds,	- - -	- - - -	5,000
Norton Company,	Worcester,	Barber,	5,000
Henry E. Dean,	Worcester,	Beaver,	5,000
Henry E. Dean,	Worcester,	Lincoln,	5,000
Elmer A. Macker,	North Grafton,	Bummit,	5,000
Gus S. Dickinson, E. A. Ludden, A. P. Morin,	North Brookfield,	Webb, Harrington,	15,000
James Nolan,	Milford,	Louisa Lake,	5,000
C. S. Robinson,	Mendon,	Thompson,	5,000
John Day,	Sturbridge,	Clay,	5,000
J. S. Hubbard,	Sturbridge,	Hinman,	5,000
W. F. Durgin,	Upton,	Taft,	5,000
W. R. Dean,	Oakham,	5-mile River,	5,000
Henry H. Hallock,	Hubbardston,	Natty,	5,000
Herbert G. Howard,	Ashburnham,	Willow,	5,000
F. A. Gravlin,	Ashburnham,	Brown Meadow,	5,000
Albert H. Sherman,	Shirley and Lunenburg,	Mulpus, Tophet, Houghton,	5,000
Arthur G. Chickering,	Lancaster,	Shoeshank,	5,000
Patrick Murphy,	Muschopauge,	Wheeler,	5,000
Arthur Snow,	Clinton and Sterling,	Sheehan,	5,000
Joseph E. Johnston,	Lancaster,	Spec. Pond,	5,000
William M. Lee,	Bolton and Berlin,	Berlin,	5,000
W. J. Tedford,	Harvard,	Harvard,	5,000
Foster A. Caples,	Athol,	Newton,	5,000
E. B. Newton,	Phillipston,	Popple Camp,	5,000
A. B. Shaw,	Athol,	Newton,	5,000
H. A. Bancroft,	Athol,	Ellinwood,	5,000
Arthur B. Perkins,	Athol,	Ellinwood,	5,000
Joseph Hamel,	Athol,	Newton,	5,000
James W. Boutell,	Athol,	Riceville,	5,000
Myron R. Goddard,	Gardner,	Hubbardston,	5,000
W. S. Richardson,	Gardner,	Poor Farm,	5,000
W. A. Streeter,	Westminster,	Marrow Meadow,	5,000
A. W. Pratt,	Gardner,	Bailey,	5,000
H. L. Curtis,	Gardner,	Bailey,	5,000
Harry J. Paige,	Gardner,	Wilder,	5,000
Elmer F. Senior,	Gardner,	Kneeland,	5,000
A. W. Littlefield,	Holliston,	Chicken,	5,000
George G. Leathe,	Gardner,	Foster,	5,000
A. D. Norcross,	Monson,	Bumstead, Conant,	10,000
A. D. Norcross,	Wales,	Cider Mill,	5,000
A. G. Moody, Charles H. Stearns, John Phelps,	Northfield,	Warwick, Hart,	15,000
Greenfield Sportsman's Club,	Northfield,	Louisiana, Panchaug,	15,000
C. P. Abbott,	Groveland,	Morrill's,	3,000
A. B. Robinson,	Georgetown,	Wheeler,	3,000
A. W. Flye,	Gloucester,	Alewife,	3,000
—— Cooney,	Rockport,	Wine,	3,000
Edmond H. Smith,	Feeding Hills,	Filo,	3,000
James E. Bemis,	North Sudbury,	Pantry,	3,000
			268,000

Fry distributed from the Winchester Hatchery during April, 1909.

Applicant.	Town.	Name of Brook.	Number.
Phillip P. Conners,	Lowell,	Meadow,	5,000
Willis S. Holt,	Andover,	Hardy's,	5,000
Henri E. Richardson,	Westford,	Snake Meadow,	5,000
Melvin G. Gooch,	Tewksbury,	Trull,	5,000
Harry L. Shedd,	Tewksbury,	Felker,	5,000
Fred E. Jones,	Tyngsborough,	Flint's,	5,000
T. H. Varnum,	Chelmsford,	Crooked Spring,	5,000
George W. Alcott,	Chelmsford,	Black,	5,000
Caleb L. Smith,	Chelmsford,	Golden Cove,	5,000
S. J. Bigelow,	Chelmsford,	Swain's,	5,000
Charles E. Blaisdell,	Dracut,	Richardson,	5,000
Herbert E. Tyler,	Weston,	Hobbs,	5,000
Henry H. Watson,	Waltham,	Beaver,	5,000
Thomas H. Bruce,	Waverley,	Clematis,	5,000
C. A. O. Grip,	Waverley,	Clematis,	5,000
Richard L. Everit,	Wellesley,	Indian Spring,	5,000
Fred W. Bean,	West Peabody,	Twist,	5,000
J. J. Kennedy,	Stoughton,	Dead Meadow,	5,000
George B. Treen,	Mansfield,	Atwood,	5,000
Henry W. Cobb,	Mansfield,	Atwood,	5,000
Charles P. Sprague,	Taunton,	Flax Mill,	5,000
Leominster Sportsmen's Association,	Leominster,	Moonoosnock, Lunenburg, Houghton,	20,000
Fitchburg Sportsman's Club,	Ashby, Ashburnham, Fitchburg, Shirley,	Willard, Lock, Trap Falls, Laws, Falulah, Shattuck, Catacoonamuc,	24,000
E. Frank Blake,	Ashland,	Cold Spring,	5,000
Charles E. Boyd,	Mansfield,	Canoe River,	5,000
C. Minton Taylor,	– – –	– – – –	5,000
E. H. Ives,	– – –	– – – –	5,000
Heman A. MacDonald,	Beverly Farms,	Bennett's,	5,000
Leslie K. Morse,	Haverhill,	Hoyt,	5,000
R. M. Keith,	Bridgewater,	Spiny,	5,000
Charles W. Davol,	Dighton,	Segregansett,	5,000
			189,000

Fingerling Trout Plants during Fall of 1909.

W. L. Taft,	Northbridge,	Northbridge,	1,000
C. V. Dudley,	Whitinsville,	Burt, Purgatory, Prentice, Bathrick,	1,000
Basil E. Aldrich,	Milford,	Bungy,	500
W. F. Durgin,	Upton,	Taft,	500
W. F. Durgin,	Mendon,	Muddy,	
E. H. Kinnicutt,	Blackstone,	Fox,	500
James B. Hodder,	Blackstone,	Fox,	500
Elmer A. Macker,	North Grafton,	Bummit,	500
Edward C. Traver,	Upton,	Braddish,	500
J. F. Despeaux,	Upton,	Banard's,	500
C. A. Barber,	Upton,	Warren,	500
E. A. Ludden, Geo. S. Dickinson, A. P. Morin,	North Brookfield,	Five-mile River,	1,500
R. E. Haskins, C. H. Clark, C. E. Bill, J. G. Shackley,	West Brookfield,	Tanny, Barrett, Budish, Tyler,	2,000
Frank F. Bullard,	East Brookfield,	Great,	500
J. Frank Stone,	East Brookfield,	Bond, Walker,	500
J. W. Barney,	West Brimfield,	Quaboag River,	1,000
E. D. Atkins,	Uxbridge,	Cold Spring,	1,000
George N. Gelley,	Sterling,	Taffs,	500
H. H. Hosley,	East Princeton,	Osgood's,	500
Henry A. Ross,	West Medway,	Black Swamp,	500
Adelbert D. Thayer,	Franklin,	Woodward, Uncas,	500
Henry U. Plympton,	Millbury,	Sawmill Stream,	500
T. B. Stevenson,	– – –	– – – –	500

Fingerling Trout Plants during Fall of 1909 — Continued.

Applicant.	Town.	Name of Brook.	Number.
P. S. Callahan,	Fiskdale,	Hyland,	500
J. L. Houde,	Sturbridge,	Hobo,	500
Dom Pocai,	Southbridge,	Brickyard,	500
Earl W. Ide,	Southbridge,	Brickyard,	500
Rufus B. Dodge,	Worcester,	Tatnuck,	500
C. L. Allen,	Worcester,	Barber,	500
Henry E. Dean,	Worcester,	Lincoln, Beaver,	1,000
C. C. Dodge,	Shrewsbury,	Wyman,	500
John F. Cummings,	Shrewsbury,	Rawson Hill,	500
Irving J. Johnson,	Shrewsbury,	Wyman,	500
Roy R. Stimpson,	Jefferson,	Mill,	500
L. G. McKnight,	Westminster,	Mare Meadow,	1,000
George F. Gehle, Joseph D. Cadle, George W. Searle, Charles H. Gehle, Howard G. Noble, Arthur Foley, Edward G. Clark, Orin E. Parks, F. F. Shepard, Michael F. Sullivan, Charles N. Oakes,	Westfield,	Timber Swamp, Sandy Mill,	5,000
Michael Sullivan,	Chicopee,	Cooley, Poor,	1,000
W. H. Roberts,	Chicopee Falls,	Poor,	500
Ira J. Humes,	Holyoke,	Tannery,	500
Fred Laduke,	Holyoke,	Broad,	500
P. M. Taylor, Harry A. Buzzell,	Longmeadow,	Pecowsie,	1,000
Edmond H. Smith,	Agawam,	Filo,	500
Charles S. Ballard,	– – –	– – – –	500
A. D. Norcross,	Monson,	Sutcliffe, Peck's, Conant, Tupper Hill,	1,000
Leominster Sportsmen's Association,	Leominster, Lunenburg, Sterling,	Moonoosnock, Massapoag, Heywood, Chocksett,	2,500
Arthur Snow, J. R. Eustace, Clinton Gun Club, W. J. Tedford,	Bolton,	Collins, Sheehan,	2,000
G. C. Wheelock,	Lancaster,	Lewis,	500
A. G. Chickering,	Lancaster,	Shoeshank,	500
Michael J. Powers,	– – –	– – – –	500
Fred R. Marsh,	Sterling,	Waushacum,	500
Robert A. Mason,	– – –	– – – –	500
Walter P. Bowers,	West Berlin,	Clamshell,	500
Gardiner L. Tarr,	Framingham,	Clay,	500
Frank D. Blake,	Ashland,	Butcher,	500
F. D. Phillips,	Hopkinton,	Indian,	500
Edward M. Prescott,	Ashland,	Waushakum,	500
L. E. Eames,	Hopkinton,	Cold Spring,	500
Charles N. Hargraves,	South Framingham,	Angelica,	500
Fitchburg Sportsman's Club,	Lunenburg,	Mulpus,	2,500
James W. Boutell,	Athol,	Riceville,	400
E. B. Newton,	Phillipston,	Popple Camp,	400
Everett King,	Phillipston,	Ellinwood,	400
Joseph Hamel,	Phillipston,	Sawyer,	400
H. L. Curtis,	Gardner,	Bailey,	250
W. A. Streeter,	Westminster,	Marrow Meadow,	250
G. E. Goddard,	Westminster,	Perley,	250
Myron R. Goddard,	Westminster,	Cook,	250
A. K. Learned,	Westminster,	Reed,	250
D. H. Gates,	Westminster,	Perley,	250
G. Stanley Lovell,	Westminster,	Foster,	250
William H. Doody,	Westminster,	Ramsdell,	250
W. P. O'Donnell,	Templeton,	Bourn and Hadley,	250
Carmi H. Baker,	South Gardner,	Nigger,	250
S. W. Rogers,	Phillipston,	Brigham,	250
Leo B. Hartwell,	Phillipston,	Gardner, Templeton,	250
Albert J. Ray,	Westminster,	Moore's,	250
A. L. Stratton,	Phillipston,	Phillipston Meadow,	250
Frank A. Gravlin,	Ashburnham,	Black,	400
H. G. Howard,	Ashburnham,	Cooper,	400

Fingerling Trout Plants during Fall of 1909 — Continued.

Applicant.	Town.	Name of Brook.	Number.
F. W. Lombard,	Ashburnham,	Blodgett,	400
F. L. Hager,	Winchendon,	Carter's,	400
Charles A. Merrill,	Winchendon,	Stockard,	400
M. C. Needham,	Oakham,	Coldbrook,	400
W. R. Dean,	Oakham,	Tributary of Five-mile River,	400
Gardner M. Dean,	Oakham,	Pratt,	400
John H. Neff,	Ware,	– – – –	400
Harold W. Robinson,	– – –	– – – –	400
Fred Sharpe,	– – –	– – – –	400
C. B. Wetherby,	– – –	– – – –	400
J. H. Schoonmaker,	– – –	– – – –	400
E. W. Lawton,	– – –	– – – –	400
Henry H. Hallock,	Hubbardston,	Natty,	400
Charles E. Gee,	North Dana,	Blackmer,	400
Greenfield Sportsman's Club,	Greenfield,	Green River, Punch and others,	2,400
John S. Coates,	Greenfield,	Wright's Mountain,	400
F. N. Wilson,	Shelburne,	Taylor,	400
J. S. Outhouse,	Charlemont,	Deerfield River,	400
A. G. Moody,	Northfield,	Louisiana, Pauchaug,	400
John Phelps,	Northfield,	Warwick, Hart,	800
Fred E. Field,	Montague,	Coldbrook,	400
R. L. Clapp,	– – –	– – – –	400
C. L. Crafts,	Whately,	Roaring,	400
Bradley C. Newell,	Rowe,	Hunt, Newell Farm,	800
A. A. Shippee,	– – –	– – – –	400
Homer Sherman,	Rowe,	Pelham Lake,	400
Lawson Ramage,	Monroe,	Dunbar,	400
John N. Moore,	Orange,	Jones,	400
H. H. Ramsey,	New Salem,	Middle Branch Swift River,	400
Rufus T. Shumway,	New Salem,	Moosehorn,	400
C. H. Sawyer,	Hatfield,	Running Gutter,	400
Walter L. Stevens,	Whately,	West,	400
George L. Harris,	Sunderland,	Welch,	400
George W. Gilbert,	Sunderland,	Meadow,	400
John A. Crosier,	Sunderland,	Mohawk,	400
F. A. Shumway,	Williamsburg,	Bradford,	400
John N. Lyman,	Easthampton,	North, Bassett's,	800
Wilfred Laro,	Easthampton,	Broad, Hammond,	400
W. A. Smith,	Goshen,	Highland,	400
John Doherty,	Goshen,	Hampshire,	400
F. E. Hawks,	Goshen,	Packard,	400
M. W. Smith,	Goshen,	Rogers,	400
L. W. Pettingill,	Cummington,	Mitchell,	400
W. S. Gabb,	Cummington,	Nipping,	400
Burt F. Fellows,	Belchertown,	Fuller's,	400
Fred D. Walker,	Belchertown,	Jabish, Thomas,	400
George M. Fisher,	Belchertown,	Jabish, Sodom,	400
J. R. Anderson,	Pelham,	Cook's,	400
Royal W. Aldrich,	Pelham,	Amethyst,	400
A. T. Mitten,	Amherst,	Swift River,	400
William Turtle,	Pittsfield,	Schoolhouse,	400
James M. Burns,	Pittsfield,	Sackett,	400
Harold C. Leonard,	West Pittsfield,	Shaker,	400
R. H. Gamwell,	Pittsfield,	Schoolhouse,	400
H. J. Coughlin,	– – –	– – – –	400
F. L. Hargreaves,	North Adams,	South Branch Hoosic,	400
A. B. Millard,	North Adams,	Hudson,	400
B. R. Millard,	Florida,	Cole River,	400
Thomas H. Hughes,	Adams,	Tophet,	400
H. O. Hicks,	Adams,	Dean,	400
Walter B. Sanford,	Great Barrington,	Seekonk, Alford,	800
Homer E. Foote,	Great Barrington,	Seekonk,	400
O. C. Bidwell,	Monterey,	Old Center, Harmon,	800
H. A. Barton,	Dalton,	Barton,	400
P. H. Clarisey,	Dalton,	Cleveland,	400
M. T. Quinlan,	Dalton,	Egypt,	400
A. Silvernail,	West Stockbridge,	McGinty,	400
E. F. Brennan,	Russell,	Blacks,	400
W. J. Cross,	Becket,	Depot, Norcett,	400
F. H. Martin,	Reading,	Willow,	1,200
C. A. O. Grip,	Weston,	Severance,	400
T. H. Bruce,	Weston	Severance, Cherry,	800
Henry H. Watson,	Weston,	Cherry,	400

Fingerling Trout Plants during Fall of 1909 — Concluded.

Applicant.	Town.	Name of Brook.	Number.
Frank J. Knight,	Townsend,	Wallace,	400
J. H. Whitcomb,	Littleton,	Beaver,	400
J. Hartwell Whitcomb,	Littleton,	Beaver,	400
George M. Fitch,	Littleton,	Beaver,	600
Louis Pleiffer,	Bedford,	Shawsheen,	400
George E. Wilkins,	Carlisle,	Hill's,	400
Walter Burkes,	– – –	– – – –	600
Harry E. Hersam,	Stoneham,	Sweetwater,	400
E. C. Cheney,	North Acton,	Cold,	400
Henry P. Andrews,	Hudson,	Hog,	400
J. Walter Smith,	– – –	– – – –	400
Pierre Gregoire,	Tyngsborough,	Gregoire's,	800
Harry L. Shedd,	Tewksbury,	Felker,	400
Willis S. Holt,	West Andover,	Hardy's,	400
Charles F. McCarthy,	Marlborough,	Bartlett, Millham,	400
E. Frank Blake,	Ashland,	Sudbury River, Johnson,	400
Herbert Tyler,	– – –	– – – –	400
Ralph H. Hosmer,	Sudbury,	Clark Pasture,	400
F. H. Hilton,	Holliston,	Overbound,	400
Albert W. Littlefield,	– – –	– – – –	400
Edward H. Yeaton,	Georgetown,	Wheeler,	800
Amos B. Robinson,	Georgetown,	Jackman,	400
Martin Carr,	Middleton,	Pine,	400
Stephen H. Sinclair,	Middleton,	Poor's,	400
David G. Wheeler,	West Peabody,	Norris,	400
Charles H. Preston,	Topsfield,	Elliott,	400
D. H. O'Brien,	Rowley,	Batchelder,	400
Everett T. Guilford,	Rowley,	Dows,	400
H. A. MacDonald,	Beverly Farms,	Sawmill,	1,200
G. R. Groesbeck,	Saugus,	Little River, Cold Spring,	400
E. L. Freeman,	Medway,	Lone Star,	400
Clyde C. Hunt,	Medway,	Gurney's,	400
Arthur LeB. Treen,	West Medway,	Hopping,	400
Harry D. Phillips,	West Medway,	Chicken,	400
Stephen D. Phillips,	West Medway,	Black Swamp,	400
F. D. Searles,	South Franklin,	Woodards,	400
Bradley M. Rockwood,	Franklin,	Country Club, Woodards,	400
Dr. R. M. Miller,	Sharon,	Beaver,	400
George B. Ames,	Dover,	Noanet,	400
C. F. McMahon,	Randolph,	Sand Hill,	400
J. J. Kennedy,	Stoughton,	Dead Meadow,	400
G. B. Treen,	Mansfield,	Spring,	400
C. S. Cobb,	Mansfield,	Spring,	400
Zebulon L. Canedy,	Lakeville,	Mullen Hill,	400
Truscott W. Tisdale,	Lakeville,	Holloway,	400
James Burke,	Westport,	Cornell,	400
Stanley A. Aldrich,	Rochester,	Doggett,	400
Thomas Taylor,	Westport,	Bread and Cheese,	400
Thomas L. Lewis,	Westport,	Noquochoke,	400
Frank M. Chace,	Assonet,	Ledge,	400
Arnold D. Gardner,	Swansea,	Millford, Gardner,	400
G. W. Fiske,	Swansea,	Swan Lake,	400
Franklin S. Simmons,	Somerset,	Hathaway's,	400
William H. Smith,	South Hadley,	Elmer, Bachelor,	800
Frank Stockwell,	Auburn,	Stone's,	400
Manuel S. Corayer,	Brockton,	Montello, Beaver,	800
Roland M. Keith,	Bridgewater,	State Farm,	800
Leslie K. Morse,	Haverhill,	Whittier, Bryant's,	1,200
Henry B. Davis,	Harwich,	Doane River,	400
Thomas H. Hughes,	Adams,	Bassett,	1,000
S. G. Tenney,	Williamstown,	Hemlock,	1,000
George B. Clark,	Carver,	White Spring,	1,000
Moses Gross,	Worcester,	Beaver,	1,000
Robert F. Brown,	Sutton,	Smith,	1,000
William Turtle,	Cheshire,	McDonald,	1,000
Homer E. Foote,	Great Barrington,	Seekonk,	1,000
Hiram L. Reynolds,	Grafton,	Newton,	1,000
Charles T. McMahon,	Randolph,	Milltown, Spring,	1,000
Charles B. Jerome,	Stockbridge,	Muddy,	1,000
C. M. Jacot,	Stockbridge,	Muddy,	1,000
Norman Barstow,	New Bedford,	Paskamansett,	1,000
Arthur L. Nason,	Haverhill,	Brown's,	1,000
A. D. Putnam,	Spencer,	Howe,	1,000
Henry S. Davis,	Ware,	Boyle, Flat,	1,000
			128,900

Ponds stocked and closed in Accordance with Chapter 91, Section 19, Revised Laws, as amended by Chapter 274, Acts of 1903, and further amended by Chapter 306, Acts of 1907.

Name of Pond.	Town.	Rainbow Trout Finger-lings.	Brown Trout Finger-lings.	Adult White Perch.
Moore's,	Warwick,	900	–	–
Gravel,	Hamilton,	–	800	–
Pratt's,	Upton,	–	1,000	–
Nabnasset,	Westford,	900	–	–
Harris,	Methuen,	1,000	–	–
Stetson,	Pembroke,	–	900	500
Kelley's,	Dennis,	–	900	–
North,	Orange,	–	1,000	–
Martin,	North Reading,	–	800	200
Walden,	Concord,	900	–	500
Prospect Lake,	Egremont,	–	1,000	–
		3,700	6,400	1,200

Ponds restocked during the Year 1909.

Name of Pond.	Town.	Brook Trout Finger-lings.	Brook Trout Adults.	Rainbow Trout Finger-lings.	Brown Trout Finger-lings.	Land-locked Smelt Eggs.
Lake Nagog,	Acton,	–	–	–	1,000	–
Lake Massapoag,	Sharon,	–	–	800	–	–
Lake Scargo,	Dennis,	–	–	–	900	–
Lake Quinsigamond,	Worcester,	–	250	–	–	–
North Pond,	Worcester,	–	–	–	–	500,000
Wales Pond,	Wales,	–	–	–	–	500,000
Reservoir Pond,	Holyoke,	1,000	–	–	1,000	–
Lake Singletary,	Sutton,	–	343	–	–	–
		1,000	593	800	2,900	1,000,000

Rivers stocked without further Action.

Name of River.	Town.	Brook Trout Adults.	Brown Trout Finger-lings.	Brown Trout Adults.	White Perch.
Quinsigamond,	Worcester,	225	–	–	–
Charles River,	Dedham,	–	4,000	–	–
Charles River Basin,	Riverside,	255	3,500	75	475
		480	7,500	75	475

[C.]

Distribution of Pheasants.

Applicant.	Town.	Number.
George Brinscombe,	North Grafton,	6
M. A. Witham,	North Grafton,	6
F. E. Wallace,	Westborough,	6
F. F. Bullard,	East Brookfield,	6
P. S. Callahan,	Fiskdale,	6
George B. Treen,	Mansfield,	8
Bradley M. Rockwood,	Franklin,	8
W. F. Durgin,	Hopedale,	10
Harry F. Pierce,	Hopedale,	10
Clyde C. Hunt,	Medway,	10
Harry D. Phillips,	West Medway,	10
Harry L. Alexander,	Taunton,	8
C. J. Kelly,	Taunton,	8
Ralph B. Dodge,	Worcester,	10
Leander F. Herrick,	Worcester,	9
Bernard W. Stanley,	Waltham,	8
James H. Grimes,	West Acton,	10
James A. Baxter,	Reading,	8
I. Pfeiffer, Jr.,	Bedford,	10
J. A. Williams,	Northbridge,	10
Lawson A. Seagrave,	Uxbridge,	10
John Parkinson,	Boston,	10
Thomas S. Lockwood,	– – – –	10
F. P. Smith,	Dedham,	10
Richard H. Bond,	Needham,	10
Richard W. Hale,	Dover,	10
George E. Patterson,	Salem,	10
S. H. Sinclair,	Salem,	10
H. T. Drew,	South Lawrence,	10
William F. Scholz,	Lawrence,	10
E. K. Dyer,	Lawrence,	10
John Bradbury,	Lawrence,	10
Leslie K. Morse,	Haverhill,	10
H. A. Smart,	Haverhill,	10
O. B. Tarbox,	Byfield,	10
E. R. Sandford,	South Byfield,	10
T. C. Wilson,	Ipswich,	10
D. H. O'Brien,	Rowley,	10
Fred D. Butler,	Pittsfield,	8
Homer E. Foote,	Great Barrington,	8

Distribution of Pheasants — Concluded.

Applicant.	Town.	Number.
Fred M. Truesdell,	Great Barrington,	8
Samuel Newell,	Great Barrington,	8
S. G. Tenney,	Williamstown,	8
Dr. Upton,	Shelburne Falls,	8
A. B. Rose,	Miller's Falls,	8
E. W. Strecker,	Greenfield,	8
John H. Neff,	Ware,	8
Edward J. Brannigan,	Ware,	8
Stephen D. Phillips,	West Medway,	8
E. L. Freeman,	West Medway,	8
William P. Pierce,	New Bedford,	10
Albert W. Lewis,	North Dartmouth,	10
William H. Seaman,	Fall River,	10
William H. Gifford,	Westport Point,	10
Franklin S. Simmons,	Somerset,	10
Lewis I. Tucker,	Taunton,	10
Herbert E. Guy,	Brockton,	10
Manuel S. Corayer,	Brockton,	10
Charles S. Baker,	Falmouth,	10
Jonathan H. Jones,	Waquoit,	10
Harry W. Plympton,	Sutton,	10
T. B. Stevenson,	Manchaug,	10
Henry E. Dean,	Worcester,	10
Charles H. Goodell,	Worcester,	8
Frank Stockwell,	Auburn,	8
H. E. Garfield,	West Dennis,	8
Francis B. Greene,	New Bedford,	8
A. T. Mitten,	Amherst,	8
Bernard W. Stanley,	Waltham,	8
A. M. Allen,	Reading,	7
Frank J. Knight,	Townsend,	7
Basil E. Aldrich,	Milford,	7
E. H. Kinnicutt,	Blackstone,	7
F. A. Moulton,	Chester,	8
Norman Shannon,	Chester,	8
Clarence C. Puffer,	Brockton,	3
		668

[D.]

Distribution of Belgian Hares.

The distributing of Belgian hares has been discontinued.

We hope next year to report the distribution of native game and insectivorous birds.

[E.]

Arrests and Convictions.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Manuel Crug,	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Convicted,	$10 00	
Antone Costa,	New Bedford,		Convicted,	10 00	
Antone Gravalho,	New Bedford,		Convicted,	10 00	
James A. Neal,	Lynn,		Convicted,	–	Filed.
John Hosker,	Lynn,		Convicted,	–	Filed.
Thomas Romanski,	Revere,		Convicted,	5 00	
Lauchlan J. Wilson,	Revere,		Convicted,	5 00	
Alexander Rose,	Revere,		Convicted,	5 00	
Albion F. Simson,	Revere,		Convicted,	5 00	
Robert Rae,	Revere,		Convicted,	5 00	
James A. Neal,	Lynn,		Convicted,	50 00	
John Hosker,	Lynn,		Convicted,	50 00	
Manuel Correia,	New Bedford,		Convicted,	10 00	
Fred J. Gaouette,	Fairhaven,		Convicted,	10 00	
Manuel Larameux,	Fairhaven,		Convicted,	10 00	
Frederick Charpenter,	New Bedford,		Convicted,	10 00	
Antone Sylvia,	New Bedford,		Convicted,	10 00	
John Ponts,	New Bedford,		Convicted,	10 00	
Laurent Fleury,	New Bedford,		Convicted,	10 00	
Joseph Cruz,	New Bedford,		Convicted,	10 00	
Joseph Rose,	New Bedford,		Convicted,	10 00	
John Costa,	New Bedford,		Convicted,	10 00	
John Duarte,	New Bedford,		Convicted,	10 00	
John H. Delory,	East Milton,		Convicted,	5 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Barnard Belif,	Hull,		Convicted,	$5 00	
John Conrad,	Hull,		Convicted,	5 00	
William Anderson,	Hull,		Convicted,	5 00	
Carl Hansen,	Hull,		Convicted,	5 00	
John Cummings,	Hull,		Convicted,	5 00	
Niles C. Neilsen,	East Boston,		Convicted,	5 00	
Otto Christensen,	East Boston,		Convicted,	5 00	
Einan Olsen,	Chelsea,		Convicted,	5 00	
Martin Olsen,	Chelsea,		Convicted,	5 00	
Daniel Daly,	Hull,		Convicted,	5 00	
Manuel F. Pacheco,	New Bedford,		Convicted,	–	Filed.
Manuel Francis,	New Bedford,		Convicted,	–	Filed.
Manuel C. Bolarink,	New Bedford,		Convicted,	–	Filed.
Clous Gagnon,	New Bedford,		Convicted,	10 00	
Henry Richard,	New Bedford,		Convicted,	10 00	
Joseph Richard,	New Bedford,		Convicted,	10 00	
Napoleon Duval,	New Bedford,		Convicted,	10 00	
Peter Babineau,	New Bedford,	Taking shellfish in violation of § 114, c. 91,	Convicted,	50 00	
Melvin P. Currier,	Lynn,	R. L., also c. 285, Acts of 1907,	Convicted,	5 00	
Frank Vail,	Lynn,		Convicted,	5 00	
James S. Savage,	Revere,		Convicted,	5 00	
Frank Cheever,	Lynn,		Convicted,	5 00	
Charles I. Stanton,	Revere,		Convicted,	–	Filed.
Charles Clough,	Lynn,		Convicted,	5 00	
William E. Barnes,	Lynn,		Convicted,	5 00	
Charles H. Stone,	Lynn,		Convicted,	5 00	
Edward Campbell,	Revere,		Convicted,	5 00	
James Waugh,	Revere,		Convicted,	–	Filed.
Joseph Scola,	Boston,		Convicted,	5 00	
Antonio Charamado,	Boston,		Convicted,	5 00	
Pietro Charamado,	Boston,		Convicted,	5 00	
Joseph Coleman,	Quincy,		Convicted,	5 00	
Joseph Miller,	Quincy,		Convicted,	5 00	
Antonio LaRosa,	Boston,		Convicted,	5 00	
Carlogero LaRosa,	Boston,		Convicted,	5 00	
Francis Plouffe,	New Bedford,		Convicted,	10 00	

Joseph Goodreau,	Acushnet,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Convicted,	10 00	
Neils Neilsen,	East Boston,		Convicted,	50 00	$40 of this fine remitted.
Charles E. Wentworth,	Lynn,		Convicted,	5 00	
Noah Robinson,	Lynn,		Convicted,	5 00	
Louis Vincent,	New Bedford,		Convicted,	10 00	
Hector Bessette,	Fairhaven,		Convicted,	10 00	
Octave Arsene,	New Bedford,		Convicted,	10 00	
Antone Rapora,	New Bedford,		Convicted,	10 00	
Oliver LeMoore,	New Bedford,		Convicted,	10 00	
Antone Santos,	New Bedford,		Convicted,	10 00	
Manuel Sylvia,	New Bedford,		Convicted,	10 00	
Henry Ferriea,	Fairhaven,		Convicted,	10 00	
Jose Leinhares,	New Bedford,		Convicted,	10 00	
Achilla Carson,	Fairhaven,		Convicted,	10 00	
Sylvester Richards,	New Bedford,		Convicted,	10 00	
Albert Crossman,	New Bedford,		Convicted,	10 00	
Lester Dore,	Taunton,	Hunting on Lord's Day in violation of § 1 c. 92, R. L., as amended by c. 176, Act, of 1904,	Convicted,	10 00	
Charles Adams,	Auburn,		Discharged,	–	
Arthur Scudder,	Taunton,		Convicted,	10 00	
Thomas Connell,	Clinton,		Convicted,	–	Filed.
H. L. Nixon,	Littleton,		Convicted,	–	Filed.
Daniel L. Reynolds,	Bradford,		Convicted,	–	Filed.
Thomas Ladeau,	Bradford,		Convicted,	20 00	
Frank Santio,	Chester,		Convicted,	10 00	
Edwin E. Farnham,	Boston,		Convicted,	10 00	
Tony Rosco,	North Adams,		Convicted,	10 00	
August F. Luca,	Milford,		Convicted,	10 00	
Mauri Carlo,	Westfield,		Convicted,	10 00	
William J. Conroy,	Brockton,		Convicted,	10 00	
Frink Dozorila,	Ludlow,		Convicted,	10 00	
Joseph Thomas,	Boston,		Convicted,	5 00	
William T. Lindstrom,	Holden,		Convicted,	10 00	
Barbee A. Miller,	Groton,		Convicted,	10 00	
Joseph Carroso,	Burlington,		Convicted,	10 00	
Edward Mali,	Burlington,		Convicted,	10 00	
Fred L. Clark,	Marlborough,		Convicted,	–	Filed.
Irving F. Gates,	Marlborough,		Convicted,	10 00	
Abiel J. Plummer,	Winchendon,		Convicted,	10 00	
Arthur Harris,	Winchendon,		Convicted,	10 00	
Dana Gillingham,	Fairhaven,		Convicted,	–	Appealed.
Edson S. Cowen,	Fairhaven,		Convicted,	–	Appealed.
Edgar Howland,	Rockland,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Charles Johnson,	Ipswich,		Convicted,	$10 00	
George Wright,	Billerica,		Convicted,	10 00	
George Small,	Billerica,		Convicted,	10 00	
Samuel Cronk,	Sandisfield,		Convicted,	10 00	
George H. Bowen,	Winchendon,		Convicted,	10 00	
Joseph Farrar,	Winchendon,		Convicted,	10 00	
Felix St. Onge,	Marlborough,		Convicted,	–	Filed.
John D. Spaulding,	Mansfield,		Convicted,	20 00	
John Kabarshitz,	Taunton,		Convicted,	10 00	Did not pay; went to jail.
Andrew Buffo,	Sheffield,		Convicted,	10 00	
Palliser Q. Wayland,	Blackstone,		Convicted,	10 00	
Joseph C. Alves,	Mendon,		Convicted,	10 00	
A. H. Eddy,	Blackstone,		Convicted,	10 00	
Hiram T. Daniels,	Blackstone,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Convicted,	10 00	
Richard Clapp,	Scituate,		Convicted,	10 00	
Everett L. Clapp,	Scituate,		Convicted,	10 00	
John Doherty,	Woburn,		Convicted,	–	Filed; paid costs court, sixty cents.
Charles Burton,	Enfield,		Discharged,	–	
Charles Randall,	Enfield,		Discharged,	–	
Ernest Crosby,	Enfield,		Discharged,	–	
Willie Deveroux,	North Spencer,		Convicted,	15 00	
Jason Woodruff,	Paxton,		Convicted,	15 00	
Charles Hosmer,	Paxton,		Convicted,	15 00	
Peter Colcair,	Orange,		Convicted,	20 00	
Frank Resno,	Scituate,		Convicted,	10 00	
Braggio Falo,	Scituate,		Convicted,	5 00	
Andriano Sabbattuci,	Milford,		Convicted,	10 00	
Alfridio Tommicio,	Milford,		Convicted,	10 00	
Charles G. Nelson,	Worcester,		Convicted,	–	Filed.
Edward F. Hicks,	Dedham,		Convicted,	10 00	
Enrico Dente,	Framingham,		Convicted,	10 00	
Frank Santio,	Chester,	Aliens hunting without license in violation of c. 317, Acts of 1905, as amended by c. 492, Acts of 1908,	Convicted,	10 00	
Tony Rosco,	North Adams,		Convicted,	–	Filed.
Augustus Messenio,	Lawrence,		Discharged,	–	
Salvatoie Musumne,	Lawrence,		Convicted,	10 00	Also costs of court, $2.60.
Charles Comeau,	Swampscott,		Convicted,	–	Filed.

Gaetano Privistera,	Lawrence,	Aliens hunting without license in violation of c. 317, Acts of 1905, as amended by c. 492, Acts of 1908,	Discharged,	–	
Raffael Depante,	Springfield,		Convicted,	10 00	
Mike Musumeri,	Lawrence,		Convicted,	10 00	
Ralph Toran,	Somerville,		Convicted,	10 00	
Michael Finaguari,	Springfield,		Convicted,	15 00	
James Chapman,	Mansfield,		Convicted,	25 00	
Antonio Romano,	Norton,		Convicted,	25 00	
Thomas G. Maloof,	Boston,		Convicted,	10 00	
Joseph Santospirito,	Marlborough,		Convicted,	10 00	
Emanuel Rando,	Marlborough,		Convicted,	10 00	
Soldoni Galdoni,	Boston,		Convicted,	10 00	
Charles Deboevere,	Lawrence,		Convicted,	10 00	
James Gabriele,	Orange,		Convicted,	10 00	
Emilio Basile,	Stoughton,		Convicted,	10 00	
Alfred Procari,	Leominster,		Convicted,	10 00	
Toney Montague,	Leominster,		Convicted,	10 00	
Angelo Masulla,	Leominster,		Discharged,	–	
Felix St. Onge,	Marlborough,		Convicted,	–	Filed.
John Kabarshitz,	Taunton,		Convicted,	–	Filed.
Andrew Buffo,	Sheffield,		Convicted,	10 00	
Frank Mack,	Leominster,		Convicted,	20 00	
Braggio Falo,	Scituate,		Convicted,	5 00	
Onorie Molle,	Marion,		Convicted,	15 00	
Andriano Sabbattuci,	Milford,		Convicted,	10 00	
Affridio Tommicio,	Milford,		Convicted,	10 00	
Charles Tebo,	West Warren,	Residents hunting without license in violation of c. 489, Acts of 1908,	Convicted,	–	Filed.
Frank W. Parmenter,	Concord,		Convicted,	10 00	
Gilbert Barnes,	Springfield,		Convicted,	10 00	
Woodrow Bassett,	Springfield,		Convicted,	10 00	
William G. Roberts,	Boston,		Convicted,	10 00	
Edson H. Bowman,	Westport,		Convicted,	10 00	
Aubrey Steen,	Revere,		Convicted,	10 00	
Melvin J. Dillon,	Boston,		Convicted,	10 00	
William Willard,	Longmeadow,		Convicted,	10 00	
Samuel Smith,	Springfield,		Discharged,	–	
Homer B. Smith,	Springfield,		Discharged,	–	
Joseph Thomas,	Boston,		Discharged,	–	
Gordon Bourque,	Revere,		Convicted,	–	Filed.
Charles Arnold,	Revere,		Convicted,	–	Filed.
John W. Downs,	Pittsfield,		Discharged,	–	
John J. Berry,	Sandwich,		Convicted,	25 00	
Horace W. Athearn,	West Tisbury,		Discharged,	–	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
William F. Tregethoff,	Springfield,	Residents hunting without license in violation of c. 489, Acts of 1908,	Convicted,	$10 00	
John Henry,	Fall River,		Convicted,	10 00	
Louis DeSousa,	Fall River,		Convicted,	10 00	
Charles Tebo,	West Warren,	Possession of, or hunting with, ferret in violation of § 11, c. 92, R. L., as amended by c. 328, Acts of 1909,	Convicted,	20 00	
Edwin Carlson,	Worcester,		Convicted,	–	Filed.
Charles A. Reno,	Marlborough,		Convicted,	5 00	
Delmar Bernache,	Northampton,		Convicted,	5 00	
William Amero,	Concord,	Killing pheasant in violation of c. 309, Acts of 1909,	Convicted,	–	Filed.
Stephen H. Bohannon,	Northborough,		Convicted,	–	Filed.
Julian R. Hood,	Somerset,		Convicted,	–	Filed; paid costs of court, $3.10.
Charles A. Darrell,	Worcester,		Convicted,	10 00	
Elmer A. Harris,	Reading,	Using over ten hooks in violation of § 26, c. 91, R. L., as amended by c. 308, Acts of 1904,	Convicted,	20 00	
Edward Crowe,	Reading,		Convicted,	–	Filed.
Josiah Horton,	Rehoboth,		Convicted,	20 00	
John DeSautels,	Fairhaven,	Having seed scallops in violation of c. 297, Acts of 1907,	Convicted,	10 00	
Nicholas Skiddere,	Chelmsford Centre,	Killing of, or possession of, gray squirrels in violation of c. 284, Acts of 1908,	Convicted,	2 00	
Henry G. Williams,	Walpole,		Convicted,	–	Filed.
Harold O. Young,	Foxborough,		Convicted,	–	Filed.
Peter Cavicchi,	Melrose,		Convicted,	10 00	
Frank L. Kinnear,	Clinton,		Convicted,	10 00	
William Williams,	Westfield,		Convicted,	10 00	
Soldoni Galdoni,	Boston,		Convicted,	10 00	
Patrick J. Coyne,	Charlemont,		Convicted,	10 00	
Harold Booth,	Charlemont,		Convicted,	10 00	
Lawrence Gale,	Charlemont,		Convicted,	10 00	
Thomas Stevens,	Springfield,		Convicted,	10 00	
Ernest R. Dickinson,	Charlemont,		Convicted,	10 00	
Gilford Gaskill,	Watertown,		Convicted,	10 00	
William G. Clark,	Franklin,		Convicted,	10 00	
Charles Blanchard,	Bernardston,		Convicted,	10 00	
Herbert Learned,	Pittsfield,		Convicted,	30 00	
John Kabarshitz,	Taunton,		Convicted,	–	Filed.
William O. Chesmore,	Holliston,		Convicted,	10 00	
Frank Mack,	Leominster,		Convicted,	10 00	
Peter Colcair,	Orange,		Convicted,	10 00	

James Serina,	East Saugus,	Hunting, wounding or killing deer in violation of § 17, c. 92, R. L., as amended by c. 377, Acts of 1908, and c. 396, Acts of 1909,	Convicted,	100 00	
Antone Serina,	East Saugus,		Convicted,	100 00	
John W. Avant,	Santuit,		Convicted,	100 00	
Charles N. Collins,	Mashpee,		Convicted,	100 00	
Clarence Avant,	Santuit,		Convicted,	100 00	
Arthur Johnson,	Malden,		Convicted,	100 00	
James Scott,	Boston,		Convicted,	100 00	
Fred Dill,	Osterville,		Convicted,	100 00	
Arthur P. Oakley,	Mashpee,		Convicted,	100 00	
James Pelkey,	Florida,		Convicted,	–	Filed.
Chauncey Burdick,	North Adams,		Convicted,	100 00	
Arthur C. Andrews,	Topsfield,		Convicted,	100 00	
Harold K. Howes,	Ashfield,		Convicted,	–	Filed.
Myron E. Harris,	Florida,		Discharged,	–	
Andrew Kennedy,	Leominster,		Discharged,	–	
Theodore P. Tower,	Cummington,		Convicted,	10 00	
Ferdinand de Jony,	Bellingham,		Convicted,	25 00	Appealed; withdrew and paid.
Leiland F. Chaffee,	Seekonk,		Convicted,	20 00	
James Giroux,	North Adams,		Discharged,	–	
William Lauderville,	North Adams,		Convicted,	10 00	
John Bourassa,	North Adams,		Convicted,	10 00	
Eli Charbaneau,	North Adams,		Convicted,	10 00	
George C. Locke,	Everett,	Shooting gulls or terns in violation of § 5, c. 92, R. L., as amended by c. 414, Acts of 1905, and c. 508, Acts of 1909,	Convicted,	10 00	
Albion K. Sylvia,	Nantucket,		Convicted,	10 00	
Guiseppe Luca,	Lynn,		Convicted,	–	Filed.
Visalli G. Rocco,	Lynn,		Convicted,	10 00	
Nathaniel C. Bartlett,	Holliston,	Setting traps, snares, etc., in violation of § 11, c. 92, R. L., as amended by c. 241, Acts of 1906,	Convicted,	–	Filed to prevent criminal record.
Charles Comeau,	Swampscott,		Convicted,	–	Filed.
Hiram G. Sumner,	Foxborough,		Convicted,	10 00	
Frank Rudolph,	Brockton,		Convicted,	20 00	
C. A. Gordon,	Swansea,	Interfering with officer,	Convicted,	30 00	
James Higgins,	Hingham,	Possession of smelts in close season in violation of § 71, c. 91, R. L.,	Convicted,	8 00	
Joseph O. Gaillardet,	Weymouth,		Convicted,	25 00	Appealed; still pending.
John Curran,	Weymouth,		Convicted,	25 00	
John C. Bently,	Weymouth,		Convicted,	25 00	
Douglass Probrab,	Weymouth,		Convicted,	25 00	
Frederick Hall,	Worcester,		Convicted,	–	Filed.
William Jones,	Worcester,		Convicted,	–	Filed.
Daniel Smith,	Worcester,		Convicted,	–	Filed.
Ferris Abdon,	Worcester,		Convicted,	–	Filed.
George Abdon,	Worcester,		Convicted,	–	Filed.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Joseph O. Gaillardet,	Weymouth,	Taking smelts with net in violation of § 72, c. 91, R. L.,	Convicted,	$50 00	Appealed; still pending.
Edward T. Burns,	Braintree,		Convicted,	50 00	On probation.
Frederick Hall,	Worcester,		Convicted,	10 00	
William Jones,	Worcester,		Convicted,	10 00	
Daniel Smith,	Worcester,		Convicted,	10 00	
Ferris Abdon,	Worcester,		Convicted,	10 00	
George Abdon,	Worcester,		Convicted,	10 00	
Herbert F. Richards,	Waltham,	Taking trout in close season in violation of c. 377, Acts of 1909,	Convicted,	10 00	
Arthur Royskis,	South Barre,		Convicted,	12 00	
Peter Susweski,	Abington,	Having pickerel under ten inches in violation of § 67, c. 91, R. L., as amended by c. 329, Acts of 1904,	Convicted,	2 00	
George M. Simpson,	Bridgewater,		Convicted,	13 00	
Orville A. Ruck,	Holyoke,		Convicted,	2 00	
Charles Eager,	Holyoke,		Convicted,	2 00	
Charles Porter,	Orange,		Convicted,	2 00	
Joseph Gardella,	Haverhill,		Convicted,	–	Filed.
Alfred Peterson,	North Attleborough,	Taking fresh-water fish with net in violation of § 132, c. 91, R. L., as amended by c. 492, Acts of 1908,	Convicted,	5 00	
Louis Pomeroy,	Westfield,		Convicted,	25 00	
Edward E. Higgins,	Westfield,		Convicted,	25 00	
Edward A. Chipman,	Harwich,		Convicted,	5 00	
Thomas A. Rogers,	Harwich,		Convicted,	5 00	
George Gage,	Lee,		Convicted,	5 00	
Dighton Brazer,	Lee,		Convicted,	5 00	
Henry B. Rounds,	Great Barrington,		Convicted,	5 00	
Ralph B. Rounds,	Great Barrington,		Convicted,	–	Filed.
James W. Ellis,	Yarmouth,		Convicted,	5 00	
Robert Carlson,	Gloucester,	Possession of lobsters under legal length in violation of § 88, c. 91, R. L., as amended by c. 303, Acts of 1907,	Convicted,	–	Filed.
Louis A. Drape,	Fall River,		Convicted,	20 00	
Arthur St. Pierre,	Fall River,		Convicted,	10 00	
Eugene Higginbottom,	Fall River,		Convicted,	10 00	
Albert White,	Onset,		Convicted,	20 00	
Freeman F. Fowler,	South Seabrook, H. N.,		Discharged,	–	Ownership not proven.
Samuel F. Fowler,	South Seabrook, N. H.,		Convicted,	30 00	
Francis J. Cook,	Woods Hole,		Convicted,	5 00	
James MacQuarrie,	New Bedford,		Convicted,	20 00	
Richard H. Bennett,	New Bedford,		Convicted,	20 00	
Charles A. Merrow,	New Bedford,		Convicted,	20 00	

Charles L. Munch,	Hull,	Possession of lobsters under legal length in violation of § 88, c. 91, R. L., as amended by c. 303, Acts of 1907,	Convicted,	5 00	
George H. Fearing,	Hingham,		Convicted,	36 00	
Edward S. Bearse,	Whitman,		Convicted,	45 00	
Gilbert Hunt,	Nahant,		Convicted,	75 00	
Frank E. Lewis,	Nahant,		Convicted,	7 50	
Samuel McDonald,	Hingham,		Convicted,	5 00	
Vinetrio Contrino,	Gloucester,		Convicted,	21 50	
Samuel Cummings,	Scituate,		Convicted,	20 00	
Valentine Powers,	Gloucester,		Convicted,	5 00	
Frank B. Silvia,	Gloucester,		Convicted,	5 50	
Moses Jellows,	Scituate,		Convicted,	24 00	
Everett Litchfield,	Scituate,		Convicted,	12 00	
Augustino Messenio,	Lawrence,	Killing song or insectivorous birds in violation of c. 329, Acts of 1903,	Convicted,	10 00	
Guiseppe Fanco,	Bellingham,		Convicted,	10 00	
Nicholas Franz,	Franklin,		Convicted,	10 00	
James Pike,	Lynn,		Convicted,	5 00	
Alexandra Selvitella,	Boston,		Convicted,	20 00	
Benjamin Thompson,	Chelsea,		Discharged,	-	
Thomas Cater,	Chelsea,		Convicted,	10 00	
Joseph Santospirito,	Marlborough,		Convicted,	10 00	
Rocco Cosato,	Stoughton,		Convicted,	20 00	
Harry Levite,	Stoughton,		Convicted,	20 00	
Joseph Caplet,	Sutton,		Convicted,	-	Filed.
Harry A. Bradley,	Lanesborough,	Possession of trout under six inches in length in violation of § 64, c. 91, R. L., as amended by c. 190, Acts of 1905, also c. 377, Acts of 1909,	Convicted,	100 00	Sentence suspended on good behavior.
George A. Shaw,	Lanesborough,		Convicted,	100 00	
Jasper Derry,	Roxbury,		Convicted,	70 00	
Myra Derry,	Roxbury,		Convicted,	40 00	
William T. Austin,	Pittsfield,		Convicted,	30 00	
Irwin P. Thompson,	Pittsfield,		Convicted,	10 00	
Wilfred Lafortune,	Adams,		Convicted,	-	Filed; paid costs of court, $2.50.
Richard W. Middlebrooks,	Lanesborough,		Convicted,	-	On probation.
John H. Bellows,	Dalton,		Convicted,	10 00	Sentence suspended.
Varider Stanley,	Southampton,		Convicted,	10 00	
White Bidwell,	Holyoke,		Convicted,	30 00	
Floyd Clark,	Monroe,		Convicted,	10 00	
William A. Buttrick,	Middleborough,		Discharged,	-	
Edward Narbery,	Westfield,		Convicted,	10 00	
Sumner C. Miller,	Holyoke,		Convicted,	10 00	
George Gage,	Lee,	Dynamiting waters in violation of § 133, c. 91, R. L., as amended by c. 246, Acts of 1903,	Convicted,	10 00	
Dighton Brazee,	Lee,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
William Carter,	Holliston,	Fishing in closed ponds in violation of § 19, c. 91, R. L., as amended by c. 306, Acts of 1907,	Convicted,	$5 00	
Fred Macker,	Springfield,		Convicted,	5 00	
Edward W. Wright,	Springfield,		Convicted,	5 00	
Martin Kennedy,	Maplewood,		Convicted,	5 00	
Joseph Ingalls,	Peabody,		Convicted,	10 00	
Peter Brunnelle,	Taunton,	Using over one hook on stocked pond in violation of § 19, c. 91, R. L., as amended by c. 306, 1907,	Convicted,	5 00	
George Bovier,	Woonsocket, R. I.,		Convicted,	10 00	
Paul Boudry,	Holyoke,		Convicted,	20 00	
Henry Langelier,	Holyoke,		Convicted,	20 00	
Benjamin Kennedy,	Mattapoisett,	Destroying or taking tern eggs in violation of § 7, c. 92, R. L., as amended by c. 250, Acts of 1907,	Convicted,	20 00	
H. A. Barlow,	Mattapoisett,		Convicted,	10 00	
Charles Rickeretson,	Fairhaven,		Convicted,	60 00	
James Quinn,	Chatham,		Convicted,	–	Filed.
Ray Speight,	Chatham,		Convicted,	–	Filed.
Allie Griffin,	Chatham,		Convicted,	–	Filed.
Albert Dexter,	New Bedford,	Possession of short bass in violation of § 70, c. 91, R. L., as amended by c. 223, Acts of 1904,	Convicted,	10 00	
Axel Hanson,	New Bedford,		Convicted,	10 00	
M. H. Adams,	Fall River,		Convicted,	10 00	
Adolph Beaulieu,	Fall River,		Convicted,	20 00	
Albert Kerjiess,	Fall River,		Convicted,	20 00	
Joseph Zabrache,	Fall River,		– –	–	Defaulted.
Michael J. Haverty,	Roxbury,		Convicted,	10 00	
Joseph Labrache,	Fall River,		Convicted,	10 00	
Frank Freeman,	Orleans,	Intent to sell egg-bearing lobsters in violation of § 86, c. 91, R. L.,	Convicted,	10 00	
Marcus M. Pierce,	Orleans,		Convicted,	10 00	
George W. Bloomer,	Chatham,		Convicted,	10 00	
Vinetrio Contrino,	Gloucester,		Convicted,	10 00	
Charles A. Horton,	Swampscott,	Mutilating lobsters in violation of § 89, c. 91, R. L.,	Convicted,	50 00	
Mike Saboli,	Boston,	Torching herring in violation of c. 298, Acts of 1908, also c. 194, Acts of 1909,	Convicted,	–	Six months house of correction; sentence suspended on good behavior.
Francisco Leota,	Boston,		Convicted,	–	
Tony Corali,	Boston,		Convicted,	50 00	
Antonido Dimino,	Boston,		Convicted,	50 00	Appealed; filed in Superior Court.
Battista Damore,	Boston,		Convicted,	50 00	Appealed; filed in Superior Court.
Joseph Scalafano,	Boston,		Convicted,	50 00	
Dominico Friscia,	Boston,		Convicted,	50 00	

Joseph Pirru,	Boston,	Torching herring in violation of c. 298, Acts of 1908, also c. 194, Acts of 1909,	Convicted,	50 00	Appealed; filed in Superior Court.
Joseph Punzo,	Boston,		Convicted,	50 00	Appealed; filed in Superior Court.
Joseph Peloso,	Boston,		Convicted,	50 00	Appealed; filed in Superior Court.
Vincent Montagnini,	Boston,		Convicted,	50 00	
Samuel McDonald,	Hingham,	Having unmarked lobster car in violation of § 119, c. 91, R. L.,	Convicted,	10 00	
Joseph Sweatt,	South Barre,	Spearing fish in violation of § 132, c. 91, R. L., as amended by c. 492, Acts of 1908,	Convicted,	–	Filed.
Mat Branski,	South Barre,		Convicted,	16 00	
Joseph Smith,	South Barre,		Convicted,	–	Filed.
Joseph Doyski,	South Barre,		Convicted,	16 00	
Charles Porter,	Orange,		Convicted,	10 00	
Vinetrio Contrino,	Gloucester,	Larceny of lobsters in violation of § 132, c. 91, R. L.,	Convicted,	25 00	
Augustus W. Baker,	Chatham,	Pursuing wild fowl with power boat in violation of § 11, c. 91, R. L., as amended by c. 328, Acts of 1909,	Convicted,	20 00	
Gordon Bourque,	Revere,		Convicted,	–	Filed.
Charles Arnold,	Revere,		Convicted,	–	Filed.
Antonio Romano,	Norton,	Assault with dangerous weapon,	Convicted,	10 00	
William P. Douchy,	New York, N. Y.,	Nonresidents hunting without license in violation of c. 198, Acts of 1907, as amended by c. 262, Acts of 1909,	Convicted,	20 00	
William E. Day,	Danbury, Conn.,		Convicted,	10 00	
Frederick Lawrence,	Danbury, Conn.,		Convicted,	10 00	
Harry K. Weddle,	Santiago, Cal.,		Convicted,	10 00	
Frank Burke,	New York, N. Y.,		Convicted,	10 00	
Albert E. Lowry,	Canton,	Possession of ruffed grouse in close season in violation of c. 441, Acts of 1908, as amended by c. 272, Acts of 1909,	Convicted,	–	Filed.
Frank Randolph,	Brockton,		Convicted,	40 00	
William J. Conroy,	Brockton,	Residents refusing to show license in violation of c. 484, Acts of 1908, as amended by c. 325, Acts of 1909,	Convicted,	–	Filed.
Harry J. Mallory,	Great Barrington,		Convicted,	5 00	
Morrill H. Abbott,	Danvers,		Convicted,	10 00	
George H. Nutter,	Lynn,	Killing rabbits in close season in violation of c. 466, Acts of 1909,	Convicted,	10 00	
Chester C. Wier,	Templeton,		Convicted,	5 00	
Earl H. Thayer,	Templeton,		Convicted,	5 00	
John F. Driscoll,	Lynn,		Convicted,	–	Filed.
Fortuna Gardell,	Westford,	Killing wood duck in violation of c. 274, Acts of 1906,	Convicted,	5 00	
Charles Haynes,	Springfield,	Using seine of less than five-inch mesh in violation of § 49, c. 91, R. L.,	Convicted,	25 00	
Benjamin Lavendure,	Springfield,		Discharged,	–	
George Lavendure,	Springfield,		Convicted,	25 00	
Ernest Crosby,	Enfield,		Convicted,	25 00	
Charles Randall,	Enfield,		Convicted,	25 00	
John Haws,	Barnstable,	Maintaining fish trap without permit in violation of § 118, c. 91, R. L.,	Convicted,	10 00	
Charles S. Ashley,	New Bedford,	Pursuing ducks in Great Pond, Edgartown, in violation of c. 264, Acts of 1907,	Convicted,	15 00	Appealed; still pending.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Chauncey Burdick,	North Adams,	Dogs chasing deer in violation of § 18, c. 92, R. L., as amended by c. 245, Acts of 1905,	Convicted,	$20 00	
Harry Martin,	Carlisle,		Convicted,	3 00	
Freeman Palmer,	Ayer,		Convicted,	–	Filed.
Abraham London,	Boston,	Possession of feathers of certain birds for millinery purposes in violation of c. 329, Acts of 1903,	Convicted,	10 00	
A. J. R. Chase,	Fall River,		Convicted,	10 00	
Maud Borneau,	Fall River,		Convicted,	10 00	
Joseph Taylor,	Fall River,		Convicted,	10 00	
Mary E. McCann,	Fall River,		Convicted,	10 00	
S. Bloom,	Fall River,		Convicted,	10 00	
L. R. Robinsky,	Fall River,		Convicted,	10 00	
Charles Frederick,	Beachmont,	Possession of black ducks in close season in violation of c. 421, Acts of 1909,	Convicted,	20 00	Filed later on account of poverty.
William E. Baker,	Fall River,	Seining pond in violation of c. 308, Acts of 1904,	Convicted,	20 00	
				$5,804 50	

[F.]

Returns from the Shore Pound and Net Fisheries for the Year 1909.

Apparatus employed.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Pounds.	Value.	Nets.	Value.
Frank C. Hodgkins, Ernest Sadler, Preston J. Marchant,	Annisquam,	11	9	$3,865 00	–	–	7	$1,100 00
E. C. Jerauld,	Barnstable,	9	4	1,100 00	2	$2,500 00	–	–
Harry Howes,	–	–	–	–	–	–	1	3 00
Edward Holway,	Bournedale,	2	3	100 00	1	1,000 00	–	–
J. Eldridge & Son, Gilbert E. Ellis, Fred Young, A. S. Hall, David A. Newcomb,	Brewster,	16	9	370 00	14	4,000 00	4	75 00
George W. Crowell, Samuel Dill, Fred W. Baker, B. N. Bloomer, William A. Bloomer, George N. Bearse, S. W. Gould & Co., R. A. Nickerson & Co., Francis A. Ellis,	Chatham,	17	11	1,163 00	9	4,350 00	34	184 00
E. C. Flanders & Co., Flanders & Look, D. W. West,	Chilmark,	16	16	1,300 00	11	8,000 00	–	–
Frank Veeder,	Cuttyhunk,	4	6	1,050 00	–	–	–	–

Apparatus employed — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Pounds.	Value.	Nets.	Value.
Hiram E. Baker, Zenas H. Baker, Crowell Cold Storage Company,	Dennis,	13	10	$1,645 00	5	$3,500 00	1	$30 00
Charles Gardner, E. D. Perry, Albertis F. Simmons,	Dighton,	18	11	570 00	–	–	10	690 00
E. R. Durkee, David B. Pease & Allen Mayhew,	Edgartown,	4	5	70 00	2	360 00	–	–
A. H. Vanderhoop & Co., L. L. Vanderhoop & Co., Linus S. Jeffers & Co., D. D. Diamond & Co.,	Gay Head,	27	20	2,608 00	14	6,700 00	2	35 00
Harry E. Hunt, Waldo F. Loring,	Duxbury,	6	7	2,048 00	2	350 00	4	430 00
Fuller A. Andrews, George W. Douglass, Joseph Douglass, Henry W. Nelson, Alexander Sargent, Frank A. Tarr, Thomas Douglass,	Gloucester,	19	17	4,782 00	3	1,150 00	11	1,700 00
Orin Crosby, Taylor Bros., Moses Sturges,	Hyannis,	9	7	1,915 00	–	–	98	850 00
Edw. W. Heath Company,	Manchester,	3	5	555 00	–	–	–	–
Burton Atwood, H. D. Powell (F. H. Johnson and others), Avard L. Smith (R. A. Atwood and others),	Nahant,	16	11	1,430 00	4	6,000 00	–	–
Arthur J. Barrett & Co., Edward J. Fisher, George H. Hamblin, Arthur McCleare, Alexander C. Swain, John S. Watkins, George M. Winslow, Robert K. Dunham,	Nantucket,	21	32	8,135 00	8	3,700 00	327	4,475 00
C. A. Caswell & Co., George G. Short,	Newburyport,	10	9	3,250 00	–	–	91	1,540 00

Atkins Hughes & Co.,	North Truro,	24	12	3,320 00	10	22,600 00	–	–
Fred C. Rich,								
Allen R. Norton, agent,	Oak Bluffs,	–	–	–	–	–	–	–
George A. Finney, agent,	Plymouth,	3	3	415 00	1	500 00	1	300 00
R. W. Cook,								
A. L. Daggett,								
James W. Fuller,								
John Johnson,								
William Joseph,								
James E. Kelley,								
A. P. Lewis & Manuel James,								
Thomas J. Lewis,								
William B. Lewis,								
Alfred A. Mayo,	Provincetown,	49	50	18,265 00	6	6,000 00	697	6,314 00
H. L. Mayo,								
Martin Nelson,								
Frank I. Sears,								
Edwin W. Smith,								
John R. Swartz,								
Manuel P. Vera,								
William Wareham,								
J. R. Williams,								
Melvin Rich,	Rockport,	–	–	–	–	–	7	40 00
Edwin Williams,	Raynham,	17	4	200 00	–	–	2	200 00
Eugene W. Haines,	Sandwich,	2	4	565 00	1	1,000 00	–	–
A. N. Goff,	Segregansett,	17	4	140 00	–	–	4	300 00
J. H. Miller,	Somerset,	9	3	130 00	–	–	2	300 00
John Elvander,	Spring Hill,	–	–	–	–	–	3	25 00
Eben Luce,	Vineyard Haven,	2	6	1,300 00	6	2,800 00	–	–
Otis B. Luce,								
George H. Luce,								
George W. Manter,								
W. L. & G. F. Tilton,								
John R. Walker,								
Obed S. Daggett,	Tisbury,	19	33	2,465 00	17	5,300 00	–	–
H. Nelson Luce,								
J. A. Mayhew & Co.,								
Henry W. Daggett,								
John J. Veeder,	Woods Hole,	3	5	5,100 00	1	500 00	–	–
Jonathan Usher,	Yarmouth,	3	3	275 00	2	500 00	–	–
Shirley D. Lovell,								
Totals for State,		369	319	$68,131 00	119	$80,750 00	1,306	$18,591 00

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Scup.
Allerton,	–	–	–	–	–	–	–	–
Annisquam,	208,875	–	–	5,376	–	382,900	–	–
Barnstable,	–	–	515	80,358	–	–	–	–
Bay View,	–	–	–	–	–	–	–	–
Beachmont,	–	–	–	–	–	–	–	–
Beverly,	–	–	450	–	–	–	–	–
Boston,	–	–	–	–	–	–	–	–
Bournedale,	–	–	–	1,037	–	1,743	–	–
Brant Rock,	–	–	–	–	–	–	–	–
Brewster,	62,550	675	27,150	3,538	–	–	–	–
Cataumet,	–	–	–	–	–	–	–	–
Chatham,	2,307	1,909	68,525	4,335	1,000	20,000	–	1,339
Chilmark,	–	–	14,341	11,660	–	1,730	–	20,874
Chiltonville,	–	–	–	–	–	–	–	–
Cohasset,	–	–	–	–	–	–	–	–
Cuttyhunk,	–	–	–	6,000	–	10,000	–	25,000
Dennis,	22,650	667	2,106	16,110	900	–	–	–
Dighton,	180,823	–	–	–	–	–	–	–
Duxbury,	–	–	–	2,120	–	8,000	–	–
Edgartown,	–	–	1,000	1,575	–	–	–	265
Essex,	–	–	–	–	–	–	–	–
Gay Head,	45,400	–	5,680	11,800	2,200	5,000	–	8,225
Gloucester,	105,300	600	175	17,623	790	192,395	–	–
Green Harbor,	–	–	–	–	–	–	–	–
Hull,	–	–	–	–	–	–	–	–
Hyannis,	–	4,925	90,100	6,483	–	–	–	–
Ipswich,	–	–	–	–	–	–	–	–
Kingston,	–	–	–	–	–	–	–	–
Lanesville,	–	–	–	–	–	–	–	–
Magnolia,	–	–	–	–	–	–	–	–
Manchester,	8,800	–	–	2,605	–	40,890	–	8,147
Manomet,	–	–	–	–	–	–	–	–
Marblehead,	–	–	–	–	–	–	–	–
Mattapoisett,	–	–	–	–	–	–	–	–
Minot,	–	–	–	–	–	–	–	–
Nahant,	–	–	–	65	7,450	3,320	–	–

in Nets, Pounds, Traps, etc.

Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Value.
–	–	–	–	–	–	–	–	1,137	$165 00
–	72,500	–	–	–	–	–	294,615	2,862	5,393 13
–	–	100	–	–	11,000	100	27,500	1,379	7,988 65
–	–	–	–	–	–	–	–	6,314	763 58
–	–	–	–	–	–	–	–	7,838	939 35
–	–	–	–	–	–	–	1,800	39,902	3,902 15
–	–	–	–	–	–	–	–	141,915	17,499 42
–	–	–	–	–	106,421	2,659	2,765	18,932	2,535 07
–	–	–	–	–	–	–	–	21,453	1,553 80
–	177,525	225	–	14	75,525	360	9,676	–	3,544 02
–	–	–	–	–	–	–	–	30	2 50
143	53,610	415	34,393	600	169,655	1,717	123,861	31,478	16,828 24
17,505	–	25	26,163	1,000	2,000	–	26,968	40,131	8,298 49
–	–	–	–	–	–	–	–	27,779	2,247 40
–	–	–	–	–	–	–	–	147,144	17,707 67
20,000	–	–	2,000	–	–	–	–	197,711	19,407 16
–	24,000	1,500	10,535	–	316,800	1,950	38,820	3,068	5,555 52
–	–	4,440	–	–	–	–	4,725	–	2,365 28
–	515,000	–	–	–	–	–	40,731	8,403	7,290 55
100	–	25	4,630	–	25,000	–	6,650	120	1,043 45
–	–	–	–	–	–	–	–	1,566	159 15
29,725	–	–	12,970	–	500	1,000	5,600	16,560	6,537 14
–	188,520	655	200	–	26,885	203	155,559	116,403	17,979 40
–	–	–	–	–	–	–	–	127,407	13,691 97
–	–	–	–	–	–	–	–	36,927	4,991 07
–	–	–	700	–	–	–	–	1,253	4,188 40
–	–	–	–	–	–	–	–	870	174 00
–	–	–	–	–	–	–	–	5,049	650 64
–	–	–	–	–	–	–	–	17,931	1,777 49
–	–	–	–	–	–	–	–	1,590	156 60
–	46,200	240	–	–	3,582	–	47,600	9,675	2,583 93
–	–	–	–	–	–	–	–	126,744	10,384 40
–	–	–	–	–	–	–	–	136,847	16,238 88
–	–	–	–	–	–	–	–	4,469	387 41
–	–	–	–	–	–	–	–	21,842	2,380 54
9,600	712,000	–	–	–	–	–	522,608	27,594	13,328 34

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Scup.
Nantasket,	–	–	–	–	–	–	–	–
Nantucket,	450	34,353	4,970	147,883	–	34,460	–	19,080
New Bedford,	–	–	–	–	–	–	–	–
Newburyport,	–	–	–	7,800	–	51,225	–	–
North Tisbury,	–	–	–	–	–	–	–	–
North Truro,	–	3,340	25,799	21,079	2,000	30,188	–	–
Oak Bluffs,	–	–	–	–	–	–	–	–
Onset,	–	–	–	–	–	–	–	–
Orleans,	–	–	–	–	–	–	–	–
Pasque Island,	–	–	–	–	–	–	–	–
Plymouth,	–	–	–	8,050	–	–	–	–
Privincetown,	–	176	903,473	210,642	–	3,300	–	–
Robinson Hole,	–	–	–	–	–	–	–	–
Rockport,	–	–	–	–	–	–	–	–
Raynham,	241,600	–	–	–	–	–	–	–
Sagamore,	–	–	–	–	–	–	–	–
Salem,	–	–	–	–	–	–	–	–
Sandwich,	–	–	–	7,362	–	–	–	–
Scituate,	–	–	–	–	–	–	–	–
Segregansett,	275,000	–	–	–	–	–	–	–
Somerset,	26,000	–	–	–	4,000	–	–	–
Spring Hill,	200	–	2,000	25	–	–	–	–
South Dartmouth,	–	–	–	–	–	–	–	–
South Duxbury,	–	–	–	–	–	–	–	–
Swampscott,	–	–	–	–	–	–	–	–
Tisbury,	2,500	3,622	25,500	16,690	–	9,130	–	8,600
Vineyard Haven,	3,250	500	5,056	2,347	–	500	–	7,760
West Falmouth,	–	–	–	–	–	–	–	–
Westport Point,	–	–	–	–	–	–	–	–
West Tisbury,	–	–	–	–	–	–	–	–
Weymouth,	–	–	–	–	–	–	–	–
Whitman,	–	–	–	–	–	–	–	–
Winthrop,	–	–	–	–	–	–	–	–
Woods Hole,	–	–	–	–	–	–	–	–
Yarmouth,	21,800	–	4,400	700	–	2,500	–	–
Totals for State,	1,207,505	50,767	1,181,240	593,263	18,340	797,281	–	99,290

in Nets, Pounds, Traps, etc. — Concluded.

Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Value.
–	–	–	–	–	–	–	–	62,607	$7,654 89
2,851	200	781	49,703	143	16,120	–	115,009	12,090	30,740 11
–	–	–	–	–	–	–	–	14,141	1,519 21
–	108,600	–	–	–	–	–	208,996	–	3,993 48
–	–	–	–	–	–	–	–	1,073	85 80
–	875,200	43	360	–	1,731,990	175	604,286	–	22,576 74
–	–	–	–	–	–	–	400	–	60 00
–	–	–	–	–	–	–	–	7,017	714 75
–	–	–	–	–	–	–	–	4,806	1,486 00
–	–	–	–	–	–	–	–	12,317	1,210 94
–	–	–	–	16	9,200	250	12,300	68,102	7,588 43
–	156,200	2,800	–	–	326,005	–	757,158	3,918	40,036 29
–	–	–	–	–	–	–	–	6,923	1,173 00
–	–	–	–	–	–	–	10,785	164,552	14,710 26
–	–	7,415	–	–	–	–	–	–	3,157 50
–	–	–	–	–	–	–	–	2,421	315 25
–	–	–	–	–	–	–	–	44,694	5,640 50
–	–	26	9	–	35,200	–	2,056	4,818	1,677 97
–	–	–	–	–	–	–	–	40,695	3,854 71
–	–	6,060	–	–	–	–	–	–	1,638 00
–	–	400	100	–	–	–	–	–	1,190 00
–	200	–	–	–	200	–	–	–	29 50
–	–	–	–	–	–	–	–	956	101 36
–	–	–	–	–	–	–	–	13,862	1,410 35
–	–	–	–	–	–	–	–	20,642	2,412 24
827	–	200	44,828	15	7,050	3,972	26,850	3,453	8,291 01
1,000	–	–	52,867	–	16,000	400	5,320	4,391	5,610 35
–	–	–	–	–	–	–	–	939	142 00
–	–	–	–	–	–	–	–	35,340	3,432 37
–	–	–	–	–	–	–	–	32,187	2,839 31
–	–	–	–	–	–	–	–	19,296	3,081 18
–	–	–	–	–	–	–	–	3,258	365 52
–	–	–	–	–	–	–	–	24,251	3,233 48
–	–	–	600	–	2,500	–	–	28,157	2,440 16
–	15,000	–	–	–	3,800	–	560	2,097	962 35
81,751	2,944,755	25,350	240,058	1,788	2,885,433	12,786	3,053,198	1,989,326	$406,014 80

Returns from the Lobster Fisheries.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
M. W. Springer,	Allerton,	1	1	$25 00	22	$25 00	758	$165 00	–
Clarence F. Davis,	Annisquam,	2	5	475 00	80	80 00	1,908	443 66	47
Winthrop O. Davis,									
Clarence Chase,	Barnstable,	2	2	255 00	30	20 00	919	217 85	15
Frank Brewer,									
Daniel S. Burnham,									
Daniel McDonald,	Bay View,	5	5	150 00	227	324 00	4,209	763 58	7
Howard Robinson,									
Jabez S. Marchant,									
Charles Neil,	Beachmont,	1	3	465 00	110	288 00	5,225	939 35	30
John Anderson and Nelson A. Southwick,									
Wallace Kenney,	Beverly,	11	12	2,650 00	663	1,131 50	26,601	3,785 15	211
C. Wallis Foster and Warren Hersey,									
Harry C. Howell,									
Albion Frye,									
Joseph Albett,									
Frank Angelo,									
Matthew P. Gill,									
Joaquin Perry,									
Tony Richamilla,									
Frank Rose,									
Joseph Serrilla,									
Antone Silva,									
Antonio Brengola,									
Frank Brengola,									
John Brengola,									
Joseph Cabral,									
A. Degaust,	Boston,	27	30	2,805 00	2,097	2,167 00	94,610	17,499 42	172
Freeman Degaust,									
Jimmie Dominic,									
John Dordes,									
Andrew Ferrairia,									

Costa Goularte,									
Dennis Mahoney,									
John Poe,									
Jule Rose,									
Manuel Rose and Manuel Grace,									
Manuel F. Vierria,									
Ben Davis,									
John Sandstrom,									
A. J. Chandler,									
Frank C. Leonard,	Bournedale,	4	6	320 00	210	275 00	12,621	1,654 46	97
Percy H. Marsh,									
Albert Nightingale,									
Clifford L. Harris,									
M. H. Hewins,									
George L. Pardy,	Brant Rock,	5	9	1,370 00	271	463 00	14,302	1,553 80	12
J. E. White,									
C. C. Cady,									
Eugene W. Benson,	Cataumet,	1	2	70 00	5	5 00	20	2 50	-
B. R. Baker,									
Fred W. Baker,									
George W. Bloomer,									
Joseph D. Bloomer and George Dunbar,									
Walter W. Eldredge,									
William R. Bloomer,									
W. N. Eldredge,									
Howard Eldridge,									
Charles G. Hamilton,									
T. W. Holway,									
James E. Jones,									
Rufus A. Nickerson & Co.,	Chatham,	32	46	8,640 00	1,715	2,188 50	20,985	7,021 63	1,840
Edson F. Olson,									
James F. Olson,									
Seymour Patterson,									
Wilbur H. Patterson,									
Albert W. Smith,									
Charles E. Smith,									
George Bearse,									
Bradford N. Bloomer,									
Walter C. Bloomer,									
William A. Bloomer,									
Samuel Dill,									
Francis A. Ellis,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Lyman Cottle,									
Roy E. Cottle,									
Jerry Look,									
William S. Mayhew,									
Everett A. Poole,	Chilmark,	11	17	$2,539 00	473	$785 00	26,754	$3,106 70	206
Harry G. Reed,									
Austin E. Smith,									
Onslow Stuart,									
J. D. and F. P. Tilton,									
Joseph Boutin,									
Ernest Johns,									
Albert F. Pierce,									
Harry S. Sampson,	Chiltonville,	13	16	990 00	325	485 00	18,519	2,247 40	72
John W. Sampson,									
Charles H. Pierce,									
R. F. Swift,									
Levi Cadose,									
John Eltman,									
Anton Grassie,									
Patrick Grassie,									
Thomas J. Mannix,									
Manuel Oliver,									
Andrew Peterson,									
Orne Peterson,									
Antone Sidney,									
Antoine L. Silvia,	Cohasset,	21	41	7,278 00	2,454	3,574 75	98,096	17,707 67	438
Manuel S. Trombas,									
George T. Ainslie,									
Antone S. Figueiredo,									
Cornelius Murphy,									
Octavius H. Reamy,									
Manuel E. Salvador,									
Joseph A. Silvia,									
Joseph M. Silvia,									
Frank Viero,									

John Beatty,									
David N. Bosworth,									
William Bosworth,									
John F. Cornell,									
Thomas Dowling,									
Arthur Gregory,									
Manuel George,									
Isaac Gregory,									
Irwin C. Hall,									
Samuel E. Jackson,									
Thomas H. Jones,	Cuttyhunk,	37	54	16,856 00	2,684	3,153 25	131,807	17,372 16	1,608
George C. King,									
Frank Peters,									
Russell W. Rotch,									
Roland S. Snow,									
Oscar H. Stetson,									
Josiah H. Tilton,									
Chester F. and Frank B. Veeder,									
Harold S. Veeder,									
John Wall,									
Ernest G. Veeder,									
Ansell P. Howes,									
Austin F. Howes,	Dennis,	4	4	50 00	79	60 00	2,045	365 25	119
Seth H. Howes,									
Benjamin Walker,									
Samuel P. Burgess,	Duxbury,	2	5	285 00	85	125 00	5,602	662 24	55
William K. Bartlett,									
Manuel Deloura,	Edgartown,	1	2	715 00	6	6 00	80	16 00	5
Edwin H. Burnham, Jr.,	Essex,	1	1	75 00	25	25 00	1,044	159 15	8
Benjamin J. Attaquin,									
Granville M. Belain,									
Moses P. Cooper,	Gay Head,	5	7	455 00	194	192 00	11,040	1,404 75	163
Joseph A. Lang,									
Charles H. Ryan,									
A. H. Vanderhoop & Co.,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Edward L. Ashley,									
Henry H. Ashley,									
J. N. Christensen,									
C. A. Dixon,									
Charles H. Douglass,									
William Gallagher,									
Nelson F. King,									
Peter Knutson,									
John C. Lycett,									
Andrew T. Marchant,									
Walter E. Marchant,									
D. E. Mehlmann,									
Forrest E. Merchant,									
Joseph S. Moniz,									
Albert and Howard Parsons,									
Edwin F. and Philip Parsons,	Gloucester,	35	49	$3,327 50	2,243	$2,421 75	77,602	$11,800 39	315
Ira Parsons,									
Melvin Parsons,									
Jerry Phillips,									
Valentine Powers,									
Nelson Rowe,									
Elbridge D. Rust,									
Everett L. Small,									
Arthur Stevens,									
Manuel Viator, Jr.,									
Daniel S. Webber,									
Joseph and Manuel Cardose,									
William McCallum,									
Frank B. Silva,									
Joseph Douglass,									
George L. Jacobs,									

Robert Brown,									
William M. Cushing,									
George Delano,									
William N. Englestead,									
Wilfred Keene,									
C. E. Peterson,	Green Harbor,	12	27	5,198 00	1,223	2,272 00	84,938	13,691 97	561
Charles R. Peterson,									
Lyman Sears,									
H. P. Tolman,									
William H. Tolman,									
George W. Gardner,									
R. M. Cleverly,									
Hulver M. Gillerson,									
Walter F. Kelley,	Hull,	6	11	1,141 00	446	811 00	24,618	4,991 07	28
Ambrose B. Mitchell,									
F. C. Munch,									
John Pinto,									
Orin Crosby,	Hyannis,	–	–	–	74	37 00	835	186 25	52
Moses Sturges,									
Frank A. Gove,	Ipswich,	1	1	150 00	43	43 00	580	174 00	34
Allen R. Gorham,	Kingston,	1	1	550 00	50	90 00	3,366	650 64	11
Edward M. Poland,									
Charles W. Lucas,									
Alfred W. Riley,									
G. W. Sargent,	Lanesville,	9	11	460 00	460	443 00	11,954	1,777 49	78
Charles H. Saunders,									
Addison H. Woodbury,									
George H. Woodbury,									
Herman Marchant,									
John G. Burnham,	Magnolia,	2	3	13 00	50	75 00	1,060	156 60	28
John B. Knowlton,									
D. C. Jones,									
L. O. Sargent,	Manchester,	4	5	687 00	210	290 00	6,450	1,253 48	142
Augustus Ferreria,									
Antone L. Silva,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
C. D. Bacon,									
Edwin H. Bartlett,									
Samuel H. Benson,									
G. L. Binney,									
G. A. Bouvier,									
Laban B. Briggs,									
James E. Burke,									
Joseph F. Cook,									
Comfort H. Dixon,									
Archie Fenton,									
Ralph B. Holmes,									
S. P. Howard,	Manomet,	28	37	$3,370 00	1,364	$2,162 00	84,496	$10,384 40	311
George A. Manter,									
Wallace J. Nightingale,									
Frank R. Peterson,									
Charles W. Raymond,									
J. E. Raymond,									
Robert Richardson,									
A. C. Sampson,									
C. A. Wakefield,									
George W. Wood,									
George D. Cook,									
Charles A. Dixon,									
Clarence A. Holmes,									
W. F. Allen,									
Charles O. Briggs,									
Ernest E. Cronk,									
W. F. Dennis,									
William Dixey,									
Peter J. Farry,									
Arthur D. Frost,									
Fred A. Fuller,									
William T. Gardner,									
Thomas P. Gilbert,									
Everett S. Hamson,									
George K. Hamson, Jr.,									
David P. Howe,									
Patrick H. Keenan,									

Thomas P. Lyons,									
John W. Mace,									
James H. Magee,									
Jonathan B. Mason,									
William F. Merritt,	Marblehead,	40	46	7,717 00	1,840	2,155 00	91,231	16,238 88	713
Richard T. Millett,									
Harry A. Oliver,									
Everett P. Peach,									
Joseph S. Phillips,									
Augustus K. Roundy,									
Richard F. Russell,									
Stephen Q. Smith,									
William T. Smith,									
Charles H. Smithurst,									
Ebenezer E. Snow,									
William B. Standley,									
Clarence X. Stone,									
Samuel A. Stone,									
John F. Trefry,									
William H. Tutt,									
J. S. Withum,									
Harvey L. Bailey,									
J. E. Brown,									
Walter E. Bowman,	Mattapoisett,	1	2	170 00	120	120 00	2,979	387 41	103
James J. Leary,									
Charles H. Pool,									
Eugene Pratt,									
Danforth P. Sylvester,	Minot,	7	7	366 00	340	485 00	14,561	2,380 54	95
Charles DeCost,									
Joy K. Gannett, Jr.,									
Charles H. Pratt,									
E. H. Crowell,									
Gilbert G. Hunt,									
G. H. Lamphier,									
Herbert E. Potter,	Nahant,	7	13	1,330 00	340	416 25	18,396	3,566 39	206
William A. Smith,									
Charles W. Taylor,									
Warren P. Taylor,									
C. F. Allen,									
Harry C. Bates,									
George L. Hatch,									
Henry E. Hatch,									
Samuel McDonald,	Nantasket,	9	12	1,252 00	574	798 50	41,738	7,654 89	186
Ephraim Onderkirk,									
Charles A. Bridgham,									
Frank Lean,									
Simon Rogers,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
E. C. and J. E. Chapel,									
Nelson Clark,									
Orin Coffin,									
James H. Dennis,									
Robert S. K. Dunham,									
William H. Hamblin,									
Walter Jewett,	Nantucket,	10	16	$2,415 00	516	$459 00	8,060	$2,392 79	211
Joseph Mayo,									
Manuel Thomas,									
C. H. Blount,									
John S. Watkins,									
Arthur McCleare,									
Joseph H. Ray,									
A. D. Peters,									
Bartholomew Silva,	New Bedford,	4	4	1,375 00	205	375 00	9,427	1,519 21	221
George B. Taber,									
Walter C. Vincent,	North Tisbury,	1	2	316 00	30	35 00	715	85 80	17
Howard C. Goodspeed,									
J. Alton Harrison,	Onset,	4	6	2,050 00	185	220 00	4,678	714 75	29
William Thompson,									
Daniel B. Gould,									
Caleb Hayden,	Orleans,	6	5	838 00	139	200 00	3,204	1,486 00	173
Marcus M. Pierce,									
Clarence King,	Pasque Island,	3	4	2,440 00	160	187 50	8,211	1,210 94	160
W. R. McDowell,									
George Atwell,									
James H. Bagnall,									
Charles A. Briggs,									
H. J. Caswell,									
John R. Harlow,									
Benjamin F. Hodges,									
Whitman Nickerson,	Plymouth,	16	23	3,078 00	674	965 00	45,401	6,516 93	111
William L. Peterson,									
A. W. Sampson,									
Frank Simmons,									
Joseph P. Thurston,									
Charles H. Davis,									
N. S. Guosso,									

Cushing H. Emery,									
Robert L. Newcomb,									
Joseph S. Perry,									
John W. Savage,	Provincetown,	6	6	440 00	230	193 50	2,612	914 89	90
W. C. Snow,									
Charles Williams, Jr.,									
Martin Nelson,									
Manuel Marshall,									
Antone Vera,	Robinson's Hole,	2	5	560 00	198	161 50	4,615	1,173 00	76
William Bennett,									
John Bowman,									
Martin Bowman,									
Gaspi Contrino,									
Peter Dixon,									
Frank Dobson,									
George H. Dobson,									
Joseph Dobson,									
G. Y. Erickson,									
Joseph Foster,									
William Garrow,									
Charles F. Green,									
W. I. Jones,									
Russell Lane,									
John F. Lawson,	Rockport,	31	35	3,645 00	2,269	2,825 00	109,701	14,496 91	146
James Long,									
Arthur Norwood,									
William E. Norwood,									
Edmond S. H. Orr,									
Arthur Rich,									
Melvin Rich,									
Raymond Rich,									
Everett D. Rowe,									
F. E. Saunders,									
Andrew Swanson,									
S. Thurston,									
Charles Upham,									
Carl Vredenburg,									
George E. Wendell,									
Herbert Rich,									
Arthur Gibbs,	Sagamore,	1	4	70 00	65	65 00	1,614	315 25	40

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Charles H. Berry,									
Charles S. Brown,									
John A. Dunn,									
John Clark,									
George W. Dunn,									
Charles P. R. Fellows,	Salem,	11	13	$1,224 00	685	$988 75	29,796	$5,640 50	365
Thomas F. Hogan,									
Louis N. Letourneau,									
Charles L. Wales,									
George H. Whelpley,									
George Brady,									
John F. Mahoney,	Sandwich,	3	5	506 00	89	95 00	3,212	641 15	61
John Elvander,									
Eugene W. Haines,									
Oscar Anderson,									
John F. Cushman,									
George F. Edson,									
Elijah P. Pratt,									
Harry Stevens,	Scituate,	9	17	1,610 00	545	940 00	27,130	3,854 71	130
Thomas S. Turner,									
Daniel Ward,									
Frank H. Barry,									
Thomas Dwyer,									
William A. Blanchard,	South Dartmouth,	2	4	1,125 00	50	45 00	637	101 36	23
James H. Butts,									
Chester N. Morse,									
Frank E. Wadsworth,	South Duxbury,	3	6	540 00	210	266 25	9,241	1,410 35	60
Samuel G. I. Wadsworth,									
Rodney Douglass,									
Walter M. Boyden,									
Henry Douglass,	Swampscott,	7	15	1,790 00	430	555 00	13,761	2,412 24	200
E. B. Thyng,									
Charles Horton,									

James F. Luce, J. A. Mayhew & Co., George W. Manter, A. L. Adams,	Tisbury,	2	3	185 00	121	191 00	2,302	803 77	52
Charles C. Chase, Edward W. Cleveland, L. W. Cleveland, H. W. McLellan, Chester H. Robinson, Edward H. Smith, L. E. Smith, James R. Tilton,	Vineyard Haven,	8	8	1,033 00	140	140 00	2,927	404 76	41
Alvin F. Bourne, F. J. Densmore,	West Falmouth,	2	2	25 00	31	49 00	626	142 00	35
George A. Gifford, William A. Hammond, William S. Head, Herman A. Hart, Fred W. Palmer, H. G. Sowle, William J. Tripp, Charles E. Valentine, William B. Whalen,	Westport Point,	12	13	3,002 00	483	665 00	23,560	3,432 37	680
Francis J. Cain, Edwin J. Culley,	Weymouth,	3	4	730 00	280	400 00	12,864	3,081 18	44
N. G. Hatch, J. S. McCallum,	Whitman,	2	2	265 00	75	135 00	2,172	365 52	3
D. H. Fullerton, Hartley L. Wells, Fred H. Baker,	Winthrop,	3	7	780 00	200	260 00	16,167	3,233 48	117
Lester D. Mayhew, Lindley W. Mayhew, F. H. Reed & Co., David T. Butler, George A. Rogers,	West Tisbury,	5	8	1,901 00	432	751 00	21,458	2,839 31	313

Returns from the Lobster Fisheries — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Walter C. Baker, Francis J. Cook, James F. Cook, J. W. Gardner, Robert A. Goffin, Charles R. Grinnell, Alfred M. Hilton, Oscar R. Hilton, W. L. Howes, Alfred Nickerson, W. E. Nickerson, F. I. Peterson, James K. P. Purdum, Prince M. Stuart, Albert S. Swain, Jr., A. H. Vedeler, John J. Veeder, Aubrey D. Wilde,	Woods Hole,	18	24	$3,182 50	362	$442 50	18,771	$2,391 16	238
Shirley D. Lovell,	Yarmouthport,	-	-	-	60	90 00	1,398	442 00	52
		522	734	$107,325 00	29,996	$39,692 50	1,326,209	$214,404 45	11,656

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REPORT

OF THE

COMMISSIONERS

ON

FISHERIES AND GAME

FOR THE

YEAR ENDING DECEMBER 31, 1910.

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1911.

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COMMISSIONERS ON FISHERIES AND GAME.

GEORGE W. FIELD, Sharon, *Chairman.*
JOHN W. DELANO, Marion.
GEORGE H. GARFIELD, Brockton.

Chief Deputy Commissioner.
WILLIAM W. NIXON, Cambridge.

Clerk.
W. RAYMOND COLLINS, Boston.

DAVID L. BELDING, Chatham, *Biologist.*
FERDINAND C. LANE, Wellfleet, *Assistant Biologist.*
ARTHUR MERRILL, Sutton, *Superintendent.*

Office: Room 158, State House, Boston.

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CONTENTS.

Appendices.

The Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-fifth annual report.

General Considerations.

The conditions connected with the maintenance of the natural and normal number of animals which are of very great biological value for the health and wealth of mankind are peculiarly complicated in Massachusetts, apart even from the political and legislative steps which annually depart from pristine conditions. Among the most notable of the peculiar conditions is the very high theoretical density of population, when figured in terms of total population and total area, but, as a matter of fact, a rather sparse population over wide areas, and excessive congestion in numerous cities, particularly in the eastern section of the State. This has resulted in —

(1) A large permanent, though floating, cosmopolitan population, including most prominently Greeks, Italians, Portuguese and Poles, which is relatively unassimilated and which to a considerable extent from its urban bases makes quasi-piratical forays upon the wild birds and animals, and upon fish, food and bait mollusks. To these people the problems of "conservation of natural resources" have never come. The rights of "free fishing, fowling and boating" appeal to such with peculiar force, but mean little beyond a stimulus to appropriate as much as possible of such public property. To these conditions are attributable much uneconomic destruction, *e.g.*, quantities of fish beyond the market supply (smelt, herring, etc.); small mackerel, bluefish, lobster and other species which are most valuable when full grown, and which resort to our shores to breed; small birds, which are of little value as food but absolutely essential to checking insect pests.

(2) An exceedingly active market demand, *e.g.,* Boston is the trading center of at least 5,000,000 people within a radius of 150 miles, as well as a shipping point for all directions.

(3) A shore line practically completely taken up by cities, towns and summer residents. One of the prime attractions to the summer residents is the possibility of securing a fresh supply of sea food under sanitary conditions. This demand is supplemented by the great number of transients swarming to the seashores during the warm season.

These conditions are especially disastrous to wild birds of all species (excepting English sparrows), to all the useful mammals (excepting the cat and dog), to all edible species of fish, mollusks and crustaceans. We are convinced that the destruction of the nests and young of our game and insectivorous birds by cats, foxes and self-hunting dogs far exceeds the annual kill by sportsmen.

Against the general slaughter are the sportsmen as a class. Although the sportsmen include about 5 per cent. of the population, and the food-consuming public outnumbers the sportsmen 20 to 1, yet game must be given special consideration as an efficient and satisfactory source of one of the best types of sport; best in the sense that it clears the brain for better work, promotes sturdy health by driving the blood more rapidly, trains the eye, develops the motor nerve centers and makes the man. Game must be maintained, therefore, as a means of developing physical manhood, clear vision, honest respect for the rights of others and a truer outlook upon life, both in the abstract and in the concrete. For these reasons, among others, it is essential that dead wild game be kept as far from the market places as possible, since market demands have been and doubtless always will be the stimulus to undue and unwise depletion.

The problem, then, in one aspect, is the personal relation of the individual to public rights and public property. Massachusetts chances to be located geographically at the confluence of two important tracts of bird migration, with a territory almost uniquely accessible, through good roads, trolleys and railroads, with its relatively large acreage of great ponds, and perhaps an equal territory of artificially flowed areas, many broad and sluggish streams in the eastern section, with numer-

ous bays, sounds and harbors where wild ducks naturally are wont to bed, with many points and islands favorable for shooting. It is, therefore, especially important that the relation of the people to the birds and to the shooting privileges should be worked out with the utmost care and a high degree of intelligence, in order that the natural assets of Massachusetts be not destroyed or even seriously impaired as a result of unwise demands, practices or laws.

To maintain the birds special attention must be given to extensive and intensive propagation work in all sections of the State upon species best adapted to each section. Most attention should be given to the native species — quail, ruffed grouse, heath hen — in special locations; the wild turkey, black, wood and mallard ducks, teal and Canada geese could be naturalized in suitable localities, and by their presence would attract migratory wild individuals to nest in the neighborhood, where bird reservations may be provided.

The 1,100 and more large lakes and ponds of the State, so long abused, can be so handled as to furnish a greatly increased annual crop of fish. In our recommendations for legislation we strongly urge increased facilities for propagating useful birds and fish, and wider provision for securing safe and attractive breeding places for wild birds within the State, both on land owned or leased by the State and on that of private owners.

The State has now been districted, and all the streams, ponds and posted lands specially favorable for bird covers and breeding places are being descriptively catalogued, so that intelligent and systematic attention may be given. This work, begun some years ago, is being extended as rapidly as our facilities permit. A systematic consideration of the sources of pollution of public waters is now under way.

We again direct your attention to the important fact that provision should be made for securing from the clam flats an annual crop as certain as that from the strawberry field. The strawberry has become one of the most satisfactory and profitable garden crops. We could not nowadays be satisfied either to depend upon the crop of wild strawberries for our market supply, or to pick the first few large berries and destroy all the others. Yet such is precisely the method pursued by the

clammers. Planting is not encouraged. No one can be offered any degree of likelihood that he may be able to reap where he has sown. Indiscriminate digging destroys thousands of clams for every one marketed. Massachusetts is the only State where similar public assets have been placed in the control of the towns, thereby diverting from the State treasury a very considerable sum. (The Rhode Island State treasury received last year $117,555.72 from the leases of the oyster grounds alone.) Shore property adapted for rearing mollusks is very carefully gardened in France, Italy, Holland, Japan and other countries.

In this connection we quote the statement from our annual report of 1909, pages 10 and 11: —

Mollusk Fisheries. — In 1905 the Legislature ordered a biological survey of the coastal areas below high-water mark, in order to ascertain: —

(1) The present and past conditions of the mollusk fisheries.

(2) The possibilities of increasing the annual production by (*a*) increasing the annual yield per acre; (*b*) suitable methods of securing an annual yield from areas at present unproductive.

(3) Ascertaining definite methods of increasing production by study of: —

(*a*) Life histories of the economic mollusks, particularly the oyster, clam, quahaug and scallop.

(*b*) Methods of feeding and rate of growth.

(*c*) Effects of unfavorable conditions; *e.g.*, pollution.

(*d*) Methods of checking ravages of enemies; *e.g.*, starfish, "drills," "winkles," etc.

A report to the Legislature upon this work states, in general, that of upwards of 60,000 acres of shellfish ground only about 3,552 acres are to-day yielding anything approximating the natural yield, *i.e.*, from $100 to $800 profit per annum; while upwards of 40,000 acres are producing at least 90 per cent. less than normal production; and about 15,000 acres at present unsuitable could at an expense of $50 to $300 per acre be made to yield from $100 to $500 profit annually. Under such development and utilization employment would be furnished to about 20,000 skilled and unskilled laborers, as compared with 2,184 in 1907; and a total production valued in the hands of the producers at $6,000,000 annually, instead of $752,000 as in 1907.

The results from more than 300 experimental plots prove conclusively that clams (*Mya arenaria*) and quahaugs (*Venus mercenaria*) can by appropriate methods be as successfully cultivated as are oysters to-day, or as any farm crop; that the value of a quahaug crop upon arrival at a marketable size often exceeds $1,800 per acre; and that the annual profit should average not less than $200 per acre.

These fisheries are prosecuted upon what is now in the east the last remnant of the public domain, viz., between high and low tide marks. The titles to the uplands have been acquired by individuals, and are subject to individual control and responsibility; and the title of the riparian owner extends to mean low-water mark, or to 100 rods beyond the mean high-water mark in cases where more than 100 rods of tidal flats are exposed by the average tide, but the riparian owner does not have an exclusive control of the fishing, fowling and boating. He may participate in these only on equal terms with the public, and subject to the disposing right of the General Court. Similarly, State laws have been enacted by which areas below high-water mark may be leased for oyster cultivation, but the lease holder can claim as his property only the oysters grown thereon. Curiously enough, present laws permit the cultivation of oysters in the waters below low-tide mark, but not clams, or scallops, either below or above low-water mark. It would be quite as logical for the State to permit the farmer to grow only corn.

The fisheries (which include the mollusk fisheries) are still public, and subject to the disposing action of the Legislature. If the Legislature should by appropriate laws make possible intensive cultivation of shellfish, *e.g.*, the oyster, clam, quahaug, scallop and lobster, in the area below high-water mark, under proper safeguards devised to secure public and private rights, there would follow: —

(1) Increased opportunities for skilled and unskilled labor.

(2) Increased yield per acre above the natural productiveness.

(3) Increased daily profits in proportion to the time and labor of the fishermen.

(4) Increased definiteness of supply, thus permitting the fishermen to take advantage of market conditions.

(5) Increased income to town from taxable property on the shellfish beds.

(6) Increased subsidiary industries.

(7) Increased revenue to citizens, communities and State, from leases of public domain.

An extended discussion is to be found in a special report to the General Court upon the mollusk fisheries of Massachusetts.

State Ponds. — During the past year commercial interests have sought to acquire control of one of the State ponds. Certain evidence was adduced at the hearings which seemed to indicate a systematic attempt to minimize the value of this pond as a State asset, where the public might exercise the "rights of free fishing, fowling and boating." Without in any degree passing an opinion as to the value of the testimony given, we urge the Legislature to consider carefully the precedent

which would be established by the alienation of the public rights in even such an undeveloped asset as Benson's Pond.

Stocking Public Waters with Food Fish. — The most notable advance this year has been to secure from the United States Bureau of Fisheries, for stocking the Charles River basin, specimens of the Potomac catfish (*Ameiurus catus*), which grows to a much greater size than our common horned pout. Whether this fish will thrive here is, of course, problematical, but the experiment is well worth the attempt. One of the most notable successes of the National Bureau of Fisheries has been the naturalization of the king or quinnat salmon of the Pacific coast in the waters of Lake Sunapee, N. H., where in three years the fry have grown to 6 and even to 14 pounds, many specimens having been taken on rod and reel last summer. Arrangements have been made for introducing this noble fish into Lake Quinsigamond, near Worcester, where the conditions appear promising, and where the abundance of landlocked smelts should furnish abundant food, and the cold, deep water meet the requirements necessary. The addition of another species to those which have already become landlocked, *e.g.*, the herring, white perch, smelt, Sebago salmon, is of very great economic importance.

Quail. — It may be of interest to know that Massachusetts is the first State to rear quail in captivity, and to liberate the artificially propagated birds for restocking the covers. This year 182 were liberated, chiefly upon State reservations. We believe that the methods used can be successfully duplicated elsewhere, and that persons who are sufficiently careful, persistent and methodical can rear quail as readily as chickens, and in larger numbers at less expense for feed. A normal population of quail upon our farm and wood lands would do much to control injurious insects, which now levy enormous taxes upon us all. Our annual output will be much greater if we are enabled to "put out" the quail, as soon as they are a month or six weeks old, in favorable localities, where they will be cared for by providing for them unharvested grain fields and protection, particularly from cats, dogs and foxes.

Pheasants. — We continue to propagate and liberate in larger numbers ringnecked pheasants, in the belief that their

value as game birds and as insect destroyers far exceeds the occasional damage to early peas, corn, etc.

National Control of Migratory Birds and Fishes. — This highly desirable federal law is now before Congress. Prompt action should be urged by every citizen of Massachusetts.

Deer. — For the first time since 1898 the Legislature permitted deer to be hunted in the five western counties. While the natural increase of deer may be estimated at 75 per cent. a year, our observations indicated that in Massachusetts the annual increase has been about 40 per cent., the prominent checks upon the natural increase being deaths due to illegal hunting, wire fences, trolley and steam cars, dogs, and injury to crops. It was estimated that at the beginning of the open season there were about 8,000 deer in the State. They had become so numerous and tame that they no longer confined themselves to the wild lands, but did extensive damage to crops. To compensate these damages even partially the State has annually paid a substantial sum, as the following table shows: —

A Comparative Statement of Money paid by the State Treasurer for Damages by Wild Deer, from 1903 to 1910 inclusive (Chapter 407, Acts of 1903).

(From Reports of State Auditor.)

Counties.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
Berkshire,	–	–	–	$143 00	$324 50	$278 00	$512 00	$452 40
Bristol,	–	–	–	–	20 00	35 00	85 00	124 75
Dukes,	–	–	–	15 00	–	–	–	–
Essex,	–	–	–	469 18	683 50	453 82	345 50	286 00
Franklin,	–	–	–	477 00	793 25	1,415 78	3,793 05	3,363 10
Hampden,	–	–	–	214 30	156 00	199 00	410 50	779 00
Hampshire,	–	–	–	295 25	263 90	326 00	746 75	585 90
Middlesex,	–	–	–	–	445 63	1,016 83	615 42	879 73
Norfolk,	–	–	–	–	15 00	–	20 00	9 80
Plymouth,	–	–	–	39 00	–	–	20 00	–
Worcester,	–	–	–	370 00	211 00	645 60	1,374 87	871 16
Total,	$237 30	$392 25	$1,117 05	$2,022 73	$2,912 78	$4,370 03	$7,923 09	$7,351 84

	1909.	1910.
Total number of claimants,	524	411
Average cost per claimant,	$15 12	$17 89
Smallest claimant, amount received,	50	1 00
Largest claimant, amount received,	175 00	140 00

During the year, from usual and various causes, 598 deer were killed. To this the record of the six days' open season added 1,413, or a total of 2,011 deer killed during 1910. Most of these were used as food, at an average market value of at least $25, or a total food value of $50,275. Against this the State has paid out a total of $26,327.07, and received at least $10,000 from hunting licenses from deer hunters. Looked at alone from one point of view the public received from this source during 1910 at least $50,000 worth of food, at a net cost to the State of $16,000.

It is true that many persons who suffered substantial damage did not seek reimbursement, and others received only partial recompense. On the other hand, many people found real pleasure in seeing the deer as a feature in the landscape. To a country where summer visitors resort, the æsthetic is a most valuable asset, and to this the wild deer are an important contribution. But however valuable in this way, the fact that the undue increase in numbers is certain to bring corresponding burdens upon land owners by destruction of crops renders imperative some efficient method of utilizing the surplus. The present method of wholesale, irresponsible slaughter is open to serious criticism. Thus far attempts to reconcile the wishes of (1) those who would exterminate the deer; (2) those who would permit none to be killed; (3) those who desire rational hunting by competent and responsible persons, have been futile. The most rational suggestion, viz., a special license for deer hunters, has thus far not prevailed against the argument of "special privilege," notwithstanding the fact that such a plan proves satisfactory in other States.

On account of the relatively large amount of traffic on our highways, trolleys and steam roads, the use of rifles would be extremely hazardous. The compactness of the territory hunted and the great number of hunters, while rendering the sole use of shot guns imperative, at the same time reduce the chance of escape of wounded deer to less than 2 per cent. In no other State, so far as we know, were 1,413 deer shot in six days without loss of human life or limb.

Expenditures. — The details of all expenditures are published in the annual report of the Auditor of the Common-

wealth. In general, $4,024.19 was expended for the benefit of the sea and shore fisheries; $7,348.01 for maintenance of inland resources, by the purchase and propagation of trout, quail, grouse and pheasants; $35,757.99 for the enforcement of the fish, game and bird laws on land and sea; $2,958.22 for the protection of adult female lobsters, by purchase of those caught when carrying eggs; $11,818.05 for the salaries of the commissioners, printing, postage, traveling expenses of the commissioners and for clerical and office expenses. The total amount of fines was $2,976; and all other additional moneys received and turned into the treasury of the Commonwealth, from the activities of this commission, amounted to $35,530.54.

Marine Fisheries.

The most important feature of the commercial marine fisheries is the development of comprehensive plans for improved facilities for handling the fresh fish brought to the Boston market. T wharf has long been inadequate and unsuitable for effective methods. Only the fact that the business is under the management of exceedingly keen, efficient and public-spirited business men has prevented unsanitary and other conditions which would seriously reflect upon the good name of the largest fresh fish market, with a single exception, in the world.

Now, fortunately, the present location on Atlantic Avenue is likely to be abandoned, and the place given up to other business for which it is more suitable. The location at South Boston is so far superior that the public are to be congratulated upon the wisdom of the Legislature and of the men who have carried the project to a successful termination. The early future thus promises not alone better trading facilities for the fishermen and dealers, but sanitary conditions superior to any in the world. From these the public will gain most largely through an increased supply of fish, put upon the market in better condition as a result of improved methods of handling and distribution. Further, assurances have been received that through the co-operation of the associated dealers with the national, State and city fisheries authorities, aided directly or indirectly by the departments of biology, chemistry and physics in the various colleges and technical schools, a beginning is to

be made in what should develop into an adequate fisheries institute, the purpose of which would be to furnish the necessary information and facilities for training men, and for original researches for economically exploiting and conserving the natural advantages of Massachusetts as a fish market for the world. The work done by the Imperial Fisheries Institute of Japan well illustrates the great value of intelligent and concerted effort for improving methods of catching and preparation of fish for the market, and for providing markets for the products.

Sea and Shore Fisheries. — While the general catch of sea fish was rather unsatisfactory, the unusual market demands, resulting from abnormal conditions in the beef supply, coupled with constantly increasing endeavors to get the fish to market in the best possible condition, resulted in higher prices to the fishermen. The mackerel season was the poorest on record, while the catch of herring and cod was below normal.

As usual, the high liner of the entire Massachusetts fleet was the schooner "Mary C. Santos," Capt. Manuel C. Santos, with a gross stock of $50,000, and the high liner of the Gloucester shack-haddocking fleet was the schooner "Thos. S. Gorton," Capt. William H. Thermos, stocking $45,000. The share of each of the crew of 23 men was $960, and the cook's share was $1,300. The "Matchless," Capt. Frank Gaspe, the "Josie and Phebe," Capt. Lawrence Norris, the "Gladys and Nellie," Capt. Frank Watts, all exceeded $40,000 gross stock.

The salt trawl-codfishermen had an average year. The knockabout schooner "Arethusa," Capt. Clayton Morrissey, with 826,327 pounds of codfish, stocking $27,362.79, establishes a new record.

The handliners had a poor year. Of the dory handliners, schooner "Elsie" weighed off 286,800 pounds, stocking $10,400, the average share being $250, while the high-line share was $281.

The seining fleet met a poor year. Schooner "Oriole," Capt. Chas. Maguire, was high line, with a stock of $9,000.

The halibut fleet had a fair year; the schooners "John Hays Hammond," "Catharine Burke," "Juno," "Dictator" are said to have stocked about $30,000 each. The schooner "Juno,"

Capt. John Streams, stocking $5,000, with a crew share of $165.86 each, established the record for a single halibut trip. He landed 39,000 pounds of halibut and 25,000 pounds of other fish.

Of the halibut flitches, the schooner "Essex," Capt. Michael Wyse, weighed off 150,300 pounds and 75 barrels of fins, stocking $13,700, the crew share being $338 each; schooner "Grayling" weighed off 144,750 pounds and 66 barrels of fins, stocking $13,200, the crew share being $333 each.

Of the dory handliners, schooner "J. J. Flaherty," Capt. Fred LeBlanc, was high liner, stocking $17,067, shares being $400 each.

The swordfishing fleet met with poor success, ascribed to "scarcity of feed" and wildness of the fish. Schooner "Lafayette," Capt. Geo. Peeples, was high line; as a result of three trips, 191 swordfish were landed, stocking $5,000, the crew share being $365.

In general, the catch of herring, squeteague, bluefish, butterfish, bass, scup, salmon, shad, squid, menhaden and other species was light. There are many indications that the trap fishing is overdone, that fewer traps would meet the market requirements, with less cost and greater profit.

Breeding Places for Fish. — There is increasing evidence that specific areas of water which are the natural breeding ground of useful fishes must be set aside as reservations, where the taking of fish must be carefully regulated.

National Control of Migratory Fish. — The migratory fish which annually resort to particular bays, estuaries and rivers for purposes of spawning cannot be regarded as the peculiar property of the States through whose waters they may chance to pass on the way to their breeding grounds, nor yet of that State in which they may breed. They are a national asset, useful as food for inland as well as seacoast communities, and should not be exposed to undue perils when approaching their spawning places. The relatively small size of the States on the Atlantic coast results in much legal, though unwise, destruction of such fish in one State when approaching the natural special spawning grounds, just over the line of an adjacent State. Many flagrant abuses can be adjusted only by national

control of migratory fish, with the establishment of suitable laws adapted for meeting special conditions existing in adjacent States. Every person interested in maintaining unimpaired our great national fisheries should actively support such a measure in Congress.

Lobster. — The lobster conditions are set forth in our report, recently published, which may be had on application to the commission. The Massachusetts lobster fishery is in a distinctly bad way, and the conditions demand immediate consideration by the public, who, after all, is most concerned.

Mollusk Fisheries. — Since 1905 we have carried on comprehensive studies upon the economic and bait mollusks, for the general purpose of ascertaining how best to utilize the coastal waters and the land below high-water mark. In 1909 was issued the general report upon "The Mollusk Fisheries of Massachusetts." In 1910 special reports, directed by chapter 74, Resolves of 1906, upon "The Scallop Fishery" and "The Lobster Fishery" were printed. A report upon "The Life History and Growth of the Quahaug" follows: —

THE LIFE HISTORY AND GROWTH OF THE QUAHAUG (*Venus mercenaria*).

Dr. George W. Field, *Chairman, Massachusetts Department of Fisheries and Game, State House, Boston, Mass.*

Sir: — I herewith submit the following report upon the life history and growth of the quahaug or hard clam (*Venus mercenaria*). All investigations herein are supplementary to those made in accordance with the provisions of chapter 78, Resolves of 1905. The work was conducted by D. L. Belding, assisted by W. H. Gates and C. L. Savery in 1906, W. G. Vinal in 1907, 1908 and 1909, F. C. Lane and A. A. Perkins in 1908 and 1909.

Respectfully submitted,

David L. Belding,
Biologist.

The report on the mollusk fisheries for 1909 presented a preliminary survey of the prevailing conditions in the natural quahaug beds of the Commonwealth, showing by maps and descriptions their extent, condition, present production, and possibility of development under cultural methods. The aim of the present paper is to complete the investigation by a final report upon the best methods of increasing the

natural supply, as determined by a study of the life history, habits and artificial propagation of this mollusk.

Object. — The investigation was conducted with four main objects in view: —

(1) To determine, if possible, a method of successfully raising seed quahaugs on a commercial basis.

(2) To find the rate of growth under various natural conditions and the length of time necessary to raise marketable quahaugs.

(3) To demonstrate the value of thousands of acres of unproductive flats along our coast.

(4) To discover methods of culture which would increase the supply and check the decline of areas now productive.

In order to satisfactorily determine these points it was found necessary to obtain information upon: —

(1) The distribution and range of the quahaug.

(2) The anatomy and its relation to the habits of the animal.

(3) The spawning, early life history, reproduction and propagation.

(4) The habits of both young and adult.

(5) The rate of growth.

(6) The quahaug fishery, — its present extent and possibilities.

(7) The cultivation of quahaugs.

As it is the purpose of this paper to present a complete account of the quahaug, it has been frequently necessary to reprint previous works as well as to present new material. No claim for originality is made for the portion on anatomy, which is largely a popular revision of Kellogg (1), (2),[1] and of a laboratory manual by Prof. Gilman A. Drew at the Marine Biological Laboratories, Woods Hole.

Courtesies. — The writer is deeply indebted to Dr. George W. Field for his general supervision and helpful advice in the investigation and in the preparation of the report; to Prof. James L. Kellogg of Williams College for preliminary instructions and kindly encouragement; to the quahaug fishermen of Massachusetts for their ready co-operation; and to Mr. L. D. Baker of Wellfleet for laboratory facilities. Specially does he wish to commend the work of his assistants, F. C. Lane and W. G. Vinal.

INTRODUCTORY.

More general knowledge concerning the quahaug should be spread abroad among the consumers and the fishermen, as the future of the quahaug industry of Massachusetts lies in the hands of her voters, and only by public sentiment can suitable laws be obtained for the preservation of the mollusk fisheries. At the present time relatively few people in the Commonwealth know anything about the quahaug, except that it lives in the mud and can be gathered with rakes. But three papers have been written upon the quahaug from a scientific or commercial

[1] The numbers after the author's name refer to the bibliography preceding the index.

standpoint. Ingersoll (8) gives an account of the fishery in 1880; Krause (5) made a preliminary outline report for the Rhode Island Commission of Inland Fisheries; and Kellogg (2) published in 1903, under the auspices of the Museum of the State of New York, the first report on the feeding habits and growth of the quahaug. Unfortunately, this important paper, in which the practical importance of quahaug culture was pointed out for the first time, is little known to the fishermen of Massachusetts. With the consent of Professor Kellogg his report was taken four years ago as a basis for this investigation, and the results here given are a continuation and an expansion of the work originally outlined by him in 1903.

Commercial Experiments. — Our aim has been to make the work thoroughly practical, and it has been undertaken scientifically because science offers the best means of approaching any practical problem. The essential aim has been to develop scientific methods for the extension of the commercial quahaug fishery.

General Results. — Four years of experiments have demonstrated with convincing force that the only method of permanently increasing the natural supply, which can be applied on a large scale, is artificial culture or quahaug farming. The quahaug grows with sufficient rapidity to warrant large returns from small capital. Many acres of unproductive flats can be turned into valuable quahaug gardens, and many men given employment by the institution, under proper legal regulations, of a system of individual leases for the planting of quahaugs. Aside from its remunerative possibilities such a system is the only means so far devised for permanently checking the decline of the natural beds.

The Quahaug Family. — The quahaug belongs to the class of mollusks called the *Lamellibranchia,* or, to use an older nomenclature, the *Pelecypoda.* According to the classification given by Pelseneer (6), in which lamellibranchs are classified by their gill structure, the quahaug is placed with the soft clam (*Mya*) and the sea clam (*Mactra*) in the class of the *Eulamellibranchia,* one of the four great orders of the lamellibranchs, which is characterized by the edges of the mantle being generally united by one or more sutures, the presence, as a rule, of two adductor muscles and the union of the gill filaments at regular intervals by vascular junctions. In addition to the many living species the subfamily to which the quahaug belongs is represented, according to Zittel (10), by many fossil forms, extending from the Jurassic to Recent.

On the New England coast, according to Gould (11), two species, *V. mercenaria* and *V. notata,* with possibly a third, *V. præparca,* more generally considered a variation of *V. notata,* are found. Of these forms, *V. mercenaria* is the most abundant, and the other two are often considered as local variations of this species.

Names. — The scientific name of *Venus mercenaria* is supposed to

have arisen from the use of the shell as "black wampum" by the Indians, as the beautiful purple tinge on the inner side of the shell made it an object of exchange among that primitive people. The common name in the New England States is "quahaug," sometimes spelled "quohog" or "cohog," while in New York and the south, where the soft clam (*Mya arenaria*) is not abundant, it is known by the name of "clam," "hard clam" or "hard-shelled clam." The small quahaug goes by the commercial name of "little neck," probably to distinguish it from the long-necked clam, *Mya,* although the claim is put forward that it was originally a local name similar to the "Blue Point" with the oyster. Ingersoll (8) states that in New Jersey they call small quahaugs, only an inch or so in breadth, "tea" clams. The present names are probably derivations of the old Indian names, such as "Poquahock," as given by Roger Williams in "A Key to the Language of America." Occasionally the monosyllable "quog" is used. The pronunciation of the word quahaug varies with the localities.

Distribution. — The quahaug, while essentially a southern and warm-water form, is found along the Atlantic coast from the Gulf of St. Lawrence to the Gulf of Mexico, where it was reported by Kellogg (3) in the vicinity of the Chandeleur Islands in 1904. Attempts are now being made to develop the fishery in Louisiana, but there is small demand for this shellfish in the local market. *Venus mercenaria* is truly an American form, its natural habitat being the Atlantic seacoast, although a few are reported to have been found in the last few years on the Pacific coast, as the result of accidental transplanting with eastern oysters.

In Massachusetts the quahaug is confined to the region of Cape Cod and the southern waters of the Commonwealth, practically no specimens being found north of the Plymouth section. As can be seen from the distribution map (Fig. 30), few quahaugs are found in Massachusetts Bay except on the north side of Cape Cod. The same state of affairs exists along the Maine coast, except in a few sheltered bays, such as Quahaug Bay, where the warm water and favorable natural conditions are such as to preserve the remnant of a once great quahaug supply. There is also evidence that a few were formerly taken near Salem, Mass. Passing northward, the quahaug again becomes abundant, and is found, according to Gould (11), at Halifax, Sable Island, Prince Edward Island, on the fishing banks and in the Gulf of St. Lawrence. At the present time a considerable number of small quahaugs of peculiar color, shape and flavor are shipped from Prince Edward Island. The present distribution, the geological changes along the coast and the evidences of former abundance, such as Indian shell heaps, are evidence, submitted by Ingersoll (8), that years ago the quahaug was more widely distributed, and that possibly on account of a decrease in the temperature along the shore of Massachusetts Bay there occurred a corresponding decrease in the supply and distribution of this mollusk.

Thus we find that the quahaug has retreated southward, Cape Cod at the present time marking, with the exceptions above noted, the northern limit of its range. In the warm waters of coast States in the south, where the quahaug develops more rapidly, there are large areas which as yet have not suffered from the effects of overfishing, as has been the case with the northern beds in New England and New York, but it will be only a short time before the history of ruthless spoliation will be repeated, as already quahaugs from the south are being shipped to the New England markets. Commercially in Massachusetts the hard clam is found both on the north and south side of Cape Cod and in Buzzard's Bay, the principal fisheries being at Wellfleet, Eastham, Orleans, Edgartown, Nantucket and in the Buzzard's Bay villages.

The same natural conditions which suit so well the shallow-water scallop (*Pecten irradians*) are also adapted to the growth of the quahaug, which is found on the sandy and muddy flats just below low-water mark, although occasionally occurring between the tide lines, particularly on the north side of Cape Cod where the great fall of the tide exposes a large area of flats. On the southern coast of the State it is mostly confined to the sheltered bays and inlets, in contrast to its more exposed conditions on the north side of Cape Cod. Owing to its natural adaptability for existing on nearly every kind of bottom, and its extensive range from high-tide line to a depth of over 50 feet, nature has provided the quahaug with a vast territory, of which the commercial fishery possesses only a small part. Scattering quahaugs are found over the rest of the area, but in paying quantities only in limited places. The possibilities of developing this great natural tract of quahaug ground are especially alluring — far more so than any of the other shellfisheries. The quahaug has a greater area, greater possible expansion and a more profitable market. Nature has equipped the numerous bays of southern Massachusetts with remarkable facilities for the production of quahaugs; it only remains for man to make the most of these advantages.

Methods of Work. — The work was conducted along three main lines: (1) a microscopical study of the early life history, including spawning, reproduction and hatching, mostly carried on by laboratory methods; (2) observations as to habits and distribution, both by laboratory experiments and by a biological survey of the quahaug territory; (3) growth and cultural experiments by means of about 187 small beds planted under a variety of conditions in the different waters of the Commonwealth. The methods of work are later described in full under each section.

Experiments have been conducted from 1905 to 1909 chiefly at two localities, (1) Monomoy Point on the south side and (2) Wellfleet harbor on the north side of Cape Cod, which represent the two classes of quahaug territory in Massachusetts. The Monomoy experiments, particularly growth, have been continued for the entire period, while

the Wellfleet investigations have been conducted only for the two years of 1908 and 1909. Owing to the necessity of concentrating the work, and from the variety of natural conditions obtainable in these two localities, particularly in Wellfleet harbor, the greater part of the work was confined to these sections. The work in other parts of the coast during this period comprised growth and cultural experiments at Plymouth, Monument Beach, Nantucket, Essex and Ipswich; determinations of the food value of the waters in the different quahauging localities; and a biological survey of the natural quahaug beds in the Commonwealth.

Excellent opportunity for the study of the life history and growth of the quahaug was afforded at Monomoy Point by the Powder Hole, formerly a harbor capable of sheltering many fishing vessels, but now little more than a small enclosed body of water connected at high tide with the ocean by a shifting channel. This natural aquarium of several acres, teeming with shellfish life, was leased for experimental purposes by the Commonwealth, and proved, by its protection and variety of natural conditions in a limited area, a most satisfactory location for the quahaug investigation. In 1906 a small shanty was fitted up as a laboratory, and a raft 20 by 10 feet was anchored in the deeper water of the Powder Hole. Growth experiments for a period of four years were conducted by suspending boxes of sand from the raft at various depths, while several methods of spat collecting were tried. In the flats and waters of the Powder Hole, under different conditions as regards current, soil and depth of water, a number of cultural experiments were established.

The conditions at Wellfleet were quite different. The harbor, some 5 miles long and nearly 2 miles wide, containing nearly 2,500 acres of quahaug ground, presented a wider and more diversified field than the limited area at Monomoy. Owing to its great rise and fall, averaging 10¾ feet, the tide sweeps in and out of the harbor with great swiftness, giving to the shellfish beds, particularly in the lower part of the bay, an excellent circulation of water, and laying bare at low water a vast area of flats. Quahaugs were found over most of this area both between the tide lines and beyond, in water ranging from a few feet to 50 feet at low tide, particularly in the channel. This section of the coast may be considered the home of the quahaug, as a large share of the total production of the Commonwealth comes from these waters. Consequently, it seemed particularly fitting that, after the preliminary experiments at Monomoy Point, this locality should be selected as the best field for the more extensive cultural experiments of 1908 and 1909. Through the kindness of Mr. L. D. Baker of Wellfleet a building was furnished for a laboratory, which served as a central headquarters for the shellfish work, and from its situation on a wharf over the water offered excellent opportunities for hatching and rearing experiments.

ANATOMY.

A description of the anatomy necessarily should be included in a report on the quahaug, as a knowledge of the general structure of the animal is essential for the proper understanding of its development and habits. Just as certain words not in everyday use by most people are found convenient to sailors, printers, mechanics and men in any occupation, so a biologist must make use of certain technical terms in his descriptions. Those used in this report, however, are not numerous and not hard to remember. They are as follows: anterior, posterior, dorsal and ventral. The two former correspond to the terms "fore" and "aft" as used by sailors. In a quahaug the anterior is the end in the direction of which he burrows, the end from which the foot protrudes. The posterior or rear end is that at which the siphon or "neck" is located. This seems a little odd, but is easily understood when we recall that the prefix "ante" means before and "post" means after. In a quahaug the dorsal side corresponds to the hinge, the ventral to the side on which the shell opens.

It is the belief of biologists of the present time that all animals of a similar kind are descended from common ancestors. Thus, the clam, oyster, quahaug, scallop, mussel, etc., are believed to have a common descent as their early development is strikingly similar. Of these forms there is reason to believe that the quahaug most closely resembles the common ancestor. The study of this typical shellfish is, therefore, especially interesting.

The Shell. — The quahaug shell is formed of two heavy valves, equal in size and curvature, which enclose the soft parts and may be drawn tightly together for protection. The two valves are joined together on the upper or dorsal side, the hinge line, by a dark elastic ligament surmounting on each side a row of teeth, which fit into corresponding depressions in the opposite valve. This ligament gives the shell a natural tendency to gape, which is offset by the action of the two adductor muscles in bringing the edges in close apposition. The shell of the adult quahaug measures slightly more in length than in width, the average dimensions being: length, 3 inches; width, 2⅗ inches; thickness, 1⅗ inches. All sizes, weights and forms can be found, depending upon age and environment. Owing to the thickness of the shell distortion is not as common as with the scallop and clam, and few deformed specimens are found. The largest quahaug known to the writer was taken in a scallop dredge off Harwichport, and measured 5¼ inches in length.

The most prominent features of the external surface are two swelling, the umbones, one on each valve, which are directed anteriorly and toward the hinge, forming the so-called beak. Many specimens show imperfect umbones, due to the wearing away of the lime. Just beneath

the beak is a depression, the part on each valve having the shape of a half moon, called the lunule, which is characteristic of the quahaug. The surface of the shell is covered with numerous concentric lines of more or less prominence, forming thin, closely packed ridges at the anterior and posterior margins, and leaving the lateral portion of the shell smooth. These ridges are more prominent in the young and rapidly growing quahaugs than in the large specimens, but they appear too irregularly and too frequently (75 to 100 on an average specimen) to be of any value in determining the age of the quahaug. In old age these growth lines pile up, showing retrogressive development, so well illustrated in the case of "blunts," where growth consists merely in a thickening of the edges. The shell is naturally free from foreign growth, although old specimens are sometimes found with shells honeycombed by the boring sponge, and quahaugs which are out of the sand are often covered with Serpula, barnacles, silver shells, grasses, etc.

On examining the interior of a valve, one sees a rough, white surface dotted with small granules between two large oval impressions, which mark the attachment of the adductor muscles. The ventral borders of the adductor muscle scars are connected by a distinct line, the pallial line, which is formed by the attachment to the shell of the mantle, a large flap forming the outer part of the body of the quahaug, and separates the white granular portion from a narrow, smooth, shiny surface, sometimes of a purple color. The posterior end of this line is indented to form the pallial sinus in which lies the siphon or neck. Just above the attachment of the adductor muscles can be seen smaller impressions, to which the muscles for moving the foot are attached. Along the hinge line are two kinds of prominent teeth, — the anterior or cardinal, consisting of short elevations; and the posterior or lateral, which extend for some distance along the dorsal margin. These teeth fit into corresponding depressions in the opposite valve, interlocking to form a compact joint. On the margin of the valve are faint vertical elevations which give the inner side a milled effect, as on a coin.

The shell is made almost entirely of lime, in some specimens crumbling on pressure in the hand. When dry quahaugs are handled in numbers, as in the shipping houses, considerable dust arises from the fine particles of lime which are rubbed off the shells, and if these quahaugs are again placed in water a white color is imparted to the fluid. Quahaugs from different localities vary in the hardness, compactness and thickness of shell, evidently due to the different amount of lime in the water. There are three layers, a rough outer, a fine middle and a thin, smooth inner, the outer being formed by the edge of the mantle, the two inner by secretions from its sides. In external appearance the shell varies from a white to a blue gray, according to the soil in which the animal is found. The heavy shell, so well adapted for the protection of the animal from enemies, makes it an almost stationary form, although it undoubtedly has the power of locomotion.

The Mantle. — The inside of both valves is closely lined by thin, semitransparent mantle lobes, which enclose the body in a fleshy case when the shell is shut. The enclosed space is called the mantle chamber. These folds are united on the hinge line, and are attached to the upper part of the visceral mass, the gills and the adductor muscles. The free border of each lobe is thickened, of white or yellow color according to the age of the quahaug, and folded into a double row of delicate frills. It contains slender muscle fibers which are attached along the pallial line of the shell. The edge of the mantle possesses sensory or tactile organs, as is shown by the withdrawal of the mantle when touched by a foreign body. The consumer can determine whether he is partaking of live or dead shellfish, as only the living form will respond in this way.

The function of the mantle is sensory, protective, respiratory, and assists in feeding. It forms a reservoir for the blood, and secretes, by numerous gland cells on the outer side and edge, a sticky substance which becomes impregnated with lime to form the new shell layers. Other cells at the edge secrete the horny cuticle, which can sometimes be seen reflected over the outer edge of the shell.

The Siphons. — On the posterior border the lobes are joined together in the form of two tubes, which are known as the siphons, or more commonly as the neck. The siphon is longer and more prominent in the soft clam (*Mya*), and the smaller fleshy extension of the quahaug is not so noticeable. Water passes in at the larger or lower opening and leaves by the smaller or upper, in this way establishing a continual circulation of microscopic food. The muscles of the siphon are heavier than those of the other part of the mantle, and form a V-shaped attachment to the shell, the pallial sinus. The siphons are yellow in color, often tinged with pigment, and bear very minute tentacles upon the outer edge, especially on the incurrent. The waste products are extruded into the stream of water passing out the excurrent siphon.

The Foot. — The quahaug has a large muscular foot resembling a plowshare, or a boat's keel, which can be thrust outward between the folds of the mantle. Its action is controlled by retractor muscles, anterior and posterior, which are attached to the shell above the adductors, and by the distension of the foot with blood. Although the shape of the foot is suggestive of a crawling existence, the quahaug makes but little use of this habit. Occasionally a groove can be seen in the sand where the quahaug has traveled a short distance. For the most part the foot is used as a burrowing organ, possibly because the heavy shell renders traveling difficult.

The Gills. — The foot merges into the abdominal portion or visceral mass, on each side of which are two conspicuous folds, the inner and outer gills, which hang free in the mantle chamber as delicate curtains between the visceral mass and mantle. The outer gills are attached at their base to the inner, which in turn are attached to a part of the

visceral mass and to the inner gills of the opposite side, dividing the mantle chamber into a larger ventral and a smaller dorsal portion, the branchial and cloacal chambers respectively. Through the gills water is passed into the cloaca, and is forced out of the upper or excurrent siphon, which is in direct connection with this chamber, while the incurrent siphon leads only into the lower apartment. The gills may be roughly compared to sieves, by which the solid particles, including the minute plants, on which the quahaug feeds, are strained from the water.

The general structure of a gill is excellently described by Kellogg (2): —

> The gills are the most complicated organs in the bodies of lamellibranchs, and must be described here as briefly and as simply as possible, without mentioning their wonderful histological structure. Outer and inner gills are practically the same. Suppose that one of these is carefully removed from its line of attachment to the body, and studied by means of the microscope from the surface and in section; such an examination shows the gill to be not a solid flap or fold, but an exquisite minute, basket-like structure with an outer and inner wall inclosing a space between. These walls are made of extremely fine rods placed side by side. In order that these rods may retain their position, they are in many forms irregularly fused with each other by secondary lateral growths of tissue. The outer and inner walls of the gills are also held together by partitions which extend across the inner space between them. The gill is thus seen to be basket-like, the walls being made of rods between which are spaces, which put the interior chamber in communication with the mantle space in which the gills hang. These rods, or filaments, of which the gill is made, contain an interior space into which the blood flows. They were probably primarily developed in order that the blood of the body might be brought in close contact with the water, that, by diffusion, the carbon dioxide of the blood might pass outward through the thin walls, while, by the same process, oxygen, carried by the water, might pass into the blood. But, in addition to performing the function of breathing, the gills have taken on that of collecting minute organisms used for food.

The Digestive System. — Just behind the anterior adductor muscle on the anterior part of the body is a funnel-shaped opening leading into a more constricted tube, the œsophagus. The mouth is guarded by two pairs of delicate ciliated flaps, triangular in shape, tapering backward toward the anterior part of the gills. These organs are the labial palps, which perhaps may be likened to the lips of higher animals, the two outer uniting to form the upper lip, the two inner the under lip, and have the power of conducting the microscopic food to the mouth. The œsophagus leads back into a stomach situated close to the dorsal wall of the visceral mass and surrounded by the liver, a paired dark-brown gland, which secretes the digestive juices. The intestine leads from the stomach in the form of a narrow tube, which, after making several

convolutions in the visceral mass, passes backward through the heart to end just over the posterior adductor muscle.

The Circulatory System. — The blood of the quahaug is a colorless liquid passing in definite channels over the whole body, bringing oxygen and nourishment to all the tissues, and removing the waste materials. The chief organ of circulation, the heart, is situated on the dorsal part of the body, posterior to the stomach, in a large triangular pericardial space. It consists of an anterior ventricle and two auricles, which have a filmy appearance. The intestine passes through the ventricle. Blood is pumped from the ventricle through two aortæ, anterior and posterior, to the various parts of the body, whence it is returned to the gills, and thence to the auricles, which open into the sides of the ventricle.

The Nervous System. — The principal nervous mechanism of the quahaug consists of three pairs of ganglia. The first pair, the cerebral, are little white round organs about the size of a pin head, situated on both sides of the mouth, just posterior to the anterior adductor muscle, and are connected by a thin commissure which passes anterior to the œsophagus. Two other commissures pass from each cerebral ganglion, one to join the visceral ganglion of the corresponding side, the other to the pedal ganglion. The visceral ganglia, pear-shaped bodies, lying just beneath the posterior adductor, are also connected by a short commissure, and supply nerves to the mantle, gill and adductor muscle. The pedal ganglia, also connected with each other and with the visceral and cerebral, are situated just dorsal to the muscular part of the foot.

The Excretory System. — The excretory organs, the nephridia, consist of dark colored tubes of glandular nature lying beneath the pericardial chamber, one on each side of the body. By one end these tubes open into the pericardium, by the other, outside the body at the base of the gills. Their function is essentially the same as the kidneys in higher animals, — the extraction of waste material from the body through the blood.

The Genital Organs. — In both sexes the light colored reproductive organs are situated in the visceral mass, just dorsal to the tough foot, where they surround the folds of the intestine, extending upward to cover part of the liver and downward into the cavities of the foot. Kellogg (1) says: " In Venus the generative gland penetrates into spaces between the uppermost bundles of the foot, as is usual in forms with a locomotor foot. The posterior part of the visceral mass has many scattered muscle bundles, generally transverse, running from one side to the other. The sexual gland pushes down among these muscles for a considerable distance." These organs open by small ducts, one on each side, which terminate close to the opening of the excretory system, beneath the free border of the inner gill. The ovaries and testes are usually white, but in older quahaugs, particularly " blunts," they have a somewhat reddish or yellow appearance.

THE EARLY LIFE HISTORY.

Ripening of the Reproductive Organs. — During the spring the ovaries or testes of the quahaug enlarge in preparation for spawning, and the visceral mass assumes a plump appearance, due to the accumulation of numerous eggs and spermatozoa. Just when the first formation of the sexual products takes place is not known, but presumably they are in process of development for several months previous to the time of spawning.

Method of determining the Sex of a Quahaug. — As described under anatomy, the sexes are separate, each quahaug probably remaining either male or female, such as it may be, all its life. During the spawning season the male can be distinguished from the female by an examination of the spawn without the microscope. As this process may be of interest to the fishermen, since it applies to all shellfish, it is here described. The quahaug is opened, the sexual organs sliced with a knife, and the spawn, after diluting with water, is spread in a thin layer on a piece of glass. If the animal is a female, this white fluid will be made up of a great number of minute specks, individually visible to the naked eye, — the eggs: if a male, the fluid will be of a uniform consistency, and will have a milky vibrant appearance, due to the invisible spermatozoa.

The Egg. — The mature egg (Fig. 1), when extruded into the water, is spherical in shape and surrounded, for protection, by a gelatinous membrane three times its diameter. The shape and size of the eggs vary somewhat, even in the same quahaug. Normally they are spherical, though occasionally one axis is slightly longer than the other; but when extruded in masses they possess irregular shapes, owing to the pressure within the ovary. This is especially noticeable in eggs cut from the ovary, and is exceptional in the natural course of spawning. Such eggs soon assume their normal shape in the water. The diameter of the average egg is 1/12.8 of a millimeter (1/325 of an inch). The color of the egg as seen by the naked eye, in mass or separately, is white. Under the microscope it has an opaque appearance, due to the yolk granules, which are packed closely in the cytoplasm. The egg is surrounded by a definite thin membrane, especially noticeable when the polar bodies are formed, differentiating it from the scallop egg.

The large gelatinous covering constitutes a distinguishing feature in differentiating the quahaug egg from other forms, as it forms a transparent film around the egg. Evidently it is formed of a substance which swells when coming in contact with water until it attains about the size of 1/102 of an inch, or 3.2 times the diameter of the egg. In observing through a microscope eggs which have been artificially fertilized by mixing with spermatozoa, a few eggs will be found free

from the covering, the majority surrounded by it, and sometimes empty cases. Usually a single egg is found in a case, but occasionally two eggs may be found in the same covering. In such instances the eggs are separate and of unequal sizes. The spermatozoa can be seen in great numbers clinging to and wiggling about the transparent film. It is interesting to note that apparently no distinction is made between the gelatinous coverings containing eggs and those without, indicating that possibly the covering and not the egg proper has the power of attracting and retaining the spermatozoa. The only noticeable difference is the absence of an inner or more dense covering, which is differentiated from the outer, when the egg is contained, by the number of spermatozoa which work their way to this second barricade. The cases without the eggs do not have this second layer.

The capsular covering is also of use to the quahaug as a means of protecting the minute egg and of preventing its sinking to the bottom. Only when the eggs are discharged "en masse" do they sink. These floating bits of protoplasm, although more easily washed ashore in rough weather, are carried farther, and do not stand as great a chance of an early death by falling on poor soil, as, for instance, the scallop eggs.

The Spermatozoön. — The spermatozoön, or male cell (Fig. 2), is composed roughly of two parts, a wedge-shaped head, the longest diameter of which, the length, is about $\frac{1}{12}$ that of the egg, and a long, whiplike tail, the motile part. Nature has so arranged in all life that the egg contains the yolk or nutriment, and is therefore the large stationary form, while the spermatozoön, as a specialized organ of locomotion for finding the egg, has thrown off all useless cell contents. The average size of the spermatozoön is: body, $\frac{1}{150}$ of a millimeter by $\frac{1}{600}$ of a millimeter ($\frac{1}{3,800}$ by $\frac{1}{15,200}$ of an inch); tail, $\frac{1}{20}$ of a millimeter ($\frac{1}{500}$ of an inch) in length. Often, variations, such as the reversed shape of the head, described by Kellogg (1), are found.

Spawning.

Spawning can best be defined as the discharge of eggs from the female or of spermatozoa from the male into the water, where fecundation takes place by their union. The sexual cells are extruded into the mantle chamber and are carried out the excurrent siphon in a fine stream, passing into the water by successive puffs. A female quahaug was observed to shoot a fine stream, not more than a millimeter in diameter, with such force as to carry it at least 2 inches from the end of the siphon before the eggs separated into a fine spray, like a jet of smoke, which held together for a time and then spread out in a cloud. This stream ended with the expulsion of stringy chunks of eggs and yellow tissue. Another quahaug shot a continuous jet of spawn for forty-four seconds. The amount of spawn extruded at any one

time was variable. The quahaugs under observation in the laboratory showed a tendency to throw their spawn little by little, although there is reason to believe that in nature it may be possible to discharge all the season's spawn at once. In the laboratory the same lots spawned three different times during the season, indicating that the quahaug is similar in this respect to the scallop.

Methods of Work. — The spawning was followed during 1909 and 1910 by keeping various sizes in tanks freely supplied with running salt water, where they could be under continual observation. For this purpose different grades of quahaugs, as "sharps," "blunts," "mediums" and "little necks," were placed in small lots in different compartments, some in sand, their natural environment, others merely in the water. (A complete description is given under "Methods of Work in Hatching.")

The Spawning Season. — The usual methods of microscopical examination, larval counts by means of the plankton net and records of the appearance of the set were used to determine the spawning season. Results also were obtained from the spawning under artificial conditions in the laboratory aquaria in 1909 and 1910.

From observation of the set, and from the size of the small quahaugs in the fall, it at first appeared that the spawning season was later than with the scallop and oyster. Investigation proved that the spawning season practically corresponds in Massachusetts waters with that of the scallop, *i.e.,* from the middle of June to the middle of August, the small size of the young quahaugs being due to slower growth. This is natural, as the quahaug, like the scallop, is essentially a southern or warm-water form, and its habits are directly influenced by temperature. Quahaugs in the Wellfleet laboratory extruded spawn in 1909 between June 23 and July 13; in 1910 as late as July 29, which further narrows the spawning limits. In the 1909 case it must be remembered that this occurred in one year, in one locality, with certain quahaugs and under possibly unnatural conditions; all of which are variable factors in the determination of the spawning season. One fact was definitely settled. The season lasts but twenty days, or less than a month, for any special batch of quahaugs; but for Massachusetts waters in general nearly two months are consumed, the greater part of the spawning, however, taking place during the last of June and the first part of July.

Temperature and Spawning. — Temperature has great influence over the distribution of all marine animals. It affects mollusks in three important ways; (1) their growth, by regulating the food supply; (2) their distribution, according to the environment; and (3) their development, as determined by spawning, early life history, etc. The time of spawning is so regulated by nature that it takes place when conditions, chiefly temperature, are favorable for the development of the unprotected embryo, which is extremely susceptible to all adversities.

Thus, spawning does not take place until the water has attained a warmth suitable for the development of the offspring. For this reason, the spawning of the quahaug in the southern waters takes place earlier than on our coast, as the requisite temperature has been reached sooner. Whether or not northern quahaugs, by the process of selection, require as warm water for the development of their offspring, and consequently spawn at a lower temperature than the southern forms, is unknown, and can be determined only by a series of observations along the Atlantic coast.

During the spawning experiments at the Wellfleet laboratory, in 1909, the following notes were made: "The first lot of spawn was given off June 23 to 26, during a sudden rise in temperature following a period of extremely cold weather for that season. The temperature of the air in the laboratory between June 23 and 26 during the day averaged from 78° to 80° F., while the water in the aquaria remained at a uniform temperature of 76° F., corresponding with the temperature of the water at the part of the harbor where the laboratory was located. On July 13 spawning again took place, the water attaining a temperature of 77° F., during a warm spell in which the laboratory temperature was 80° F. Between June 26 and July 13 no spawning was observed. It is interesting to note that the water between these dates was only moderately warm, averaging 71° F., and that spawning occurred simultaneously with a rise in temperature of the water, in each case reaching about 76°, which appears to be the 'spawning temperature' for Wellfleet, although in other localities it may be different."

In the light of these experiments the act of spawning during the summer may be likened to the operation of an automatic thermostat, which, when a certain temperature is reached, allows the escape of the contents held under pressure in the distended sexual organs. All the writer's observations tend to prove that temperature is the controlling factor in the spawning of the quahaug, and that the variations, either for different years or in different localities, whether on the north or south side of Cape Cod, in Buzzard's Bay or in the States south of Massachusetts, are primarily due to differences in temperature.

Age and Spawning. — The average quahaug is capable of spawning when two years old, its third summer, as sexual products can be found at that age. The size of the average two-year-old quahaug is between 1¼ and 1½ inches. It is well to realize that size, not age, is of importance in considering sexual maturity, and that a rapidly growing mollusk reaches reproductive activity sooner than a slowly growing specimen. Observations at Wellfleet in 1909 indicate that the quahaug is of little value as a "spawner" until it has attained a size of 2½ inches. In the spawning tanks the quahaugs were separated into small lots, according to size. Practically uniform conditions existed as regards flow of water, temperature, etc. The large (3 to 3¾ inches) and

the small "sharps" (2½ to 3 inches) were the only quahaugs to spawn. The "little necks" (under 2½ inches) and the "blunts" (old quahaugs) did not throw any eggs or spermatozoa. This fact, if universally true, has an important commercial bearing on the capture of "blunts," as it would tend to show the fallacy of reserving the old "blunts" for "spawners." Before definite conclusions can be drawn frequent tests should be made to verify this observation. Under the conditions in the Wellfleet laboratory the distinction in size, class and age was sharply marked at three different intervals, quahaugs of the same sizes being the only ones to spawn. If the above observations hold generally true, it means that the quahaug has a period of sexual maturity only during middle life. On the other hand, it is a fact that sexual products are found in varying abundance in both "little necks" and "blunts," when the sexual organs are opened, but no proof that they are discharged can be given.

Two peculiarities which may be mere chance were shown by the spawning in the laboratory tanks.

(1) The spawning occurred at night on June 23, 24, 26 and July 13, 1909. No spawning during the daytime was observed until July 29, 1910, when the quahaugs spawned at 5 P.M. The spawning on June 23 and 24 occurred toward morning, while on June 26 and July 13 it took place in the first part of the night; on July 13 beginning at 8 P.M. Although it is probably the result of coincidence that most all the spawning took place at night, it is barely possible that the quahaug, buried under the sand in the deep water, is not influenced, as the scallop, by sunlight, and that darkness is a factor in natural spawning.

(2) The quahaugs in the spawning tanks were divided into two classes: (*a*) those buried naturally in sand; (*b*) those lying on the bottom of the tank without sand. The second class alone furnished the spawn. Possibly their unusual position and environment made them more susceptible to changes in temperature, and therefore more responsive.

Natural Fecundation. — By the act of spawning the parent quahaug completes its duty to its offspring. But a new individual does not begin even to exist, and no development can take place until a union of the egg and spermatozoön takes place. The reason for the vast number of eggs is now disclosed. The chances of union are rendered more and more uncertain as the swift tides bear away the eggs and spermatozoa. No one can answer definitely what per cent. of the eggs are fertilized in nature, as conditions are constantly varying and fecundation depends almost wholly on chance. It is no wonder that the quahaug needs many millions of eggs, unprotected as they are, since they have to pass through a series of adverse conditions, the first of which is the element of chance in the union of egg and spermatozoön.

Between the egg and the spermatozoön is an attraction which scien-

tists tell us is of a chemical nature, and the minute spermatozoön is drawn irresistibly toward the egg, its final goal. How far this attraction zone extends through the water is not known, but under the microscope eggs can be observed fairly covered by a circle of spermatozoa, as if held there by some centripetal force. But one of these can gain an entrance, as after the body of the spermatozoa has entered the egg to fuse with its nucleus (germinative part) an impenetrable membrane is formed around the egg, shutting out the others. This fusion of the male and female pronucleus gives life to the young quahaug, which now starts through the series of changes described under the heading "Embryology."

All through its early existence, until it is large enough to settle into the sand, the young embryo is subject to continual danger on all sides. Under natural conditions, if but one out of the millions of eggs laid by a single quahaug reaches maturity, it is sufficient to perpetuate the species. The young embryo is thus forced to lead a continual struggle for existence, with but meager chance of survival. If, favored by chance, the union of the egg and spermatozoön takes place, the new individual is from six to twelve days at the mercy of the natural elements. Sudden changes in temperature or in the salinity of the water, such as cold rains, diminish the number of larvæ; the waves and tides wash many ashore; polluted waters may destroy; all manner of sea animals devour them as food; and, finally, the greater part of the remainder fall on poor ground, where they soon perish. The few that fall on good ground are still subject to the attacks of predaceous animals until they attain a sufficient size to resist those enemies.

Hatching.

Although the young quahaugs, from the time of byssal attachment, had been studied since 1906 in the laboratory, successful fertilization was not achieved until 1909, when several lots of embryos were developed in the spawning tanks. This occasion furnished an opportunity to study the embryology and complete the work on the early life history.

The essential object in this work was to find, if possible, a method of artificial hatching which would make possible the raising of seed quahaugs on a commercial scale. The question of seed is of the greatest importance to the quahaug culturist, as the natural beds cannot, as in the case of the clam, furnish a sufficient quantity for an extensive industry. The results of the experimental work in this direction so far have been somewhat discouraging. Two methods of obtaining seed seem possible: (1) the catching of the set in spat boxes in a manner parallel to the catching of oyster seed; the work on this point will be discussed under the subject of "Spat Collecting," which has met with more or less success; (2) the artificial rearing of the quahaug from the egg through the larval stages to a size suitable for planting. By pro-

tecting the helpless larva from its enemies during the most critical period of its life, it may be possible to reduce the great infant mortality, and raise thousands artificially to nature's one. So far we have been able to raise only a few quahaugs to the veliger (shell) stage, the majority perishing for various reasons, chief among which seems to be the lack of food and space. Our experiments have been so designed that if successful on a small scale they could readily be enlarged to meet the requirements of a business enterprise. The work is discouraging from a commercial standpoint from the fact that the chief cause of failure is due to the crowding of the larvæ, whereas to give the young quahaugs a sufficient amount of space would so materially increase the expense of production as to prohibit hatching. However, there are many things to encourage continuation of experiments along this line with the hope of ultimate success.

At the present time it would seem that the liberation in large numbers of larvæ one day old would undoubtedly be of benefit. This could easily be done, as the embryos do not die rapidly, when confined, until the second day. Our experiments have shown that a small number can be raised in the laboratory, enough for the study of the early life history, but that when large numbers are tried the result is unsatisfactory.

Methods of Work in Hatching. — Attempts were first made to fertilize the eggs by abstracting the spawn from male and female quahaugs by artificial cutting, and mixing these in the water. No satisfactory results were obtained by this method, as the eggs would not develop normally. It was finally decided to keep adult quahaugs in tanks supplied by running salt water, and to remove the spawn to special rearing tanks as soon as it appeared.

No facilities for such work were available until the summer of 1909, when a small one-horse power gasoline engine and pump were installed at the Wellfleet laboratory, which is situated on a wharf over the water. At high tide water could be pumped to a large wooden tank at the top of the building, which served as a reservoir. From this tank water was conducted by a large pipe to different parts of the laboratory, where it was supplied to the hatching tanks by rubber hose.

For hatching purposes we used wooden tubs, made of large hogsheads cut in two in the middle, through which passed a continuous stream of water. In order that the flow of water might be maintained without loss of larvæ, the water was drained off through sand filters, fitted so that they could be readily cleaned. This arrangement was accomplished by fitting into the bottom of the tub several short pieces of 3-inch galvanized iron piping in a vertical position. Sand was held in the pipes by wire netting on the bottom and could be removed when desired. For the purpose of aëration the salt water was forced in fine streams into the tanks, keeping the young larvæ

under uniform conditions as regarded temperature, food supply and flow of water.

At the beginning of the spawning season the quahaugs were kept in ordinary tanks. When spawn was discharged into the water it was transferred to the special tubs previously described, and efforts were made to rear the embryos under what seemed to all purposes natural conditions. Large glass aquaria and glass hatching jars were also utilized, the eggs in the latter being constantly kept in slow motion by means of a double inflow of water, one on the bottom furnishing the circulation, the other on the top aërating the water. All sorts of combinations, such as varying the amount of spawn, the rate of flow, the kind of jars, and selecting the more active larvæ by siphoning, were tried in vain, as the quahaug embryos perished in great numbers, only a few reaching the veliger stage.

Embryology.

The embryology of practically all the *Lamellibranchiata* is strikingly similar, the eggs passing through identically the same stages and differing but little in appearance. This similarity holds true until after the formation of the embryonic shell. During the first part of the veliger (embryonic shell) stage the predominating type of a straight-hinged veliger holds true; and it is only in the last part of this period that differentiation in structure and form between species can be noticed. In the report on the scallop the embryology has been described in detail, and in the following pages, owing to the great similarity of the quahaug and scallop larvæ, only a brief description of the general features will be given, emphasis being placed on the points of difference. For a more complete description the reader is referred to the life history of the scallop, published in a previous report.

The first distinction has been already mentioned, the gelatinous case which surrounds the quahaug egg, whereas the scallop egg is naked. The majority of eggs remain within this covering until they become ciliated embryos, when by the rotary action of the cilia they break from its folds. It was a frequent occurrence to observe through the microscope embryos rapidly revolving within the cases.

Polar Cells. — About twenty-five minutes after the egg is laid, two clear transparent bodies, apparently containing no yolk granules, are given off at the flattened animal pole (Fig. 3). The first body by its appearance clearly demonstrates the presence of a membrane about the egg, as it is formed beneath the membrane, which forms part of the adhering strands for the polar cells.

Yolk Lobe. — The appearance of the polar bodies is followed by the formation of a poorly developed yolk lobe (Fig. 3), by no means as conspicuous as in the case of the scallop. No constriction, such as is found with the scallop, is observed with the quahaug egg; but the

nutritive material is confined to one end, which later becomes the large yolk cell (Fig. 4). Just previous to the first segmentation the egg elongates into a pear-like body, the yolk lobe constituting the broad end. The elongation takes place in a direction horizontal to the polar cells and not vertical, as with the scallop.

Cleavage. — The quahaug egg develops by the same process of unequal cell division as the scallop, although the time and form of the divisions are different. The difference in time is probably unimportant, as the warmth of the water has a great deal to do with the rapidity of development in mollusk larvæ. The first cleavage (Fig. 5) is noticed thirty-five minutes after fertilization, and at the end of fifty minutes the majority of the eggs are in the 2-cell stage. The actual time from the beginning to the completion of the first cleavage for individual eggs is about three minutes. The average time for the completion of each cleavage after fertilization for the majority of the eggs was as follows: 4 cells (Fig. 10), one hundred and ten minutes; 8 cells (Fig. 11), one hundred and forty-five minutes; 16 cells (Fig. 13), one hundred and eighty-five minutes; 32 cells (Fig. 14), two hundred minutes.

The principal difference between the cleavage of the quahaug and the scallop egg is found during the first segmentation, and is chiefly due to the elongation in opposite directions. In both cases the first division gives 2 cells, a large and a small; with the scallop the larger cell has an elongated form, due to the construction of the yolk lobe, while with the quahaug both cells are spherical.

The egg passes through the 16, 32, 64, etc., celled stages, until the primitive ovum has become a compact mass of small cells (Fig. 12) surrounding a group of large cells, containing the nutritive yolk. This is the blastula stage of the embryo, which soon becomes a true gastrula by an invagination which forms the primitive digestive tract. About the age of ten hours the surface cells acquire minute hair-like processes (Fig. 15) called cilia, which enable the animal to move. Up to this period the egg has developed inside the transparent case, but the lashing of the cilia soon tears apart the protective covering, and the animal escapes, as a swimming embryo, into the water.

Trochosphere Larvæ. — By the time the embryo is able to break forth from its case the random revolutions of its early ciliated stage have changed, and a new larva, more elongated in form, swims through the water with a definite spiral movement, rotating voluntarily around its longitudinal axis in either direction. The new type of embryo is called a trochosphere (Fig. 16), and reaches that stage at the age of twelve to fourteen hours. It is differentiated from the ciliated gastrula by having an elongated or top-like body; by having the cilia confined to the blunt anterior end; the formation of a primitive mouth; and the appearance of a shell gland opposite the mouth. The trochosphere stage of the quahaug and the scallop are identical in regard to (1)

form of animal; (2) mouth; (3) shell gland; (4) methods of swimming. The only difference lies in the flagellum, or whip-like feeler, formed in the scallop larvæ by the elongation of certain cilia on the anterior end, but probably absent in the quahaug.

In the course of the next twenty-four hours a thin transparent shell (Fig. 17) creeps slowly over the animal, until it completely envelops the soft parts. During this period the animal can be observed swimming through the water with its organs partly covered by two thin valves. The shell is formed by the secretion from the shell gland, which becomes calcified at two points, forming the two valves. With the spreading of the shell various changes of more or less importance, both in the anatomy and habits of the young quahaug, have taken place, giving rise to a period in its development known as the veliger stage, perhaps the most critical and important period of its existence.

The Veliger. — The early veliger (Fig. 18), formed about thirty-six hours after fertilization, is a different appearing animal than the swimming larva of the early stages. When first formed it has a transparent shell with a straight hinge line, which is nearly always held open at an angle of 45°, whether the quahaug is resting on the bottom or in the act of swimming. The animal at this time is but little larger than the trochosphere larva, the empty space between the soft body of the animal and the shell constituting the only gain in size. The ciliated velum has no flagellum, the stomach is prominent, two adductor muscles are present, and teeth are apparently present on the hinge line. The animal swims by means of a velum which is not extruded from the shell. This is the description of an undeveloped quahaug veliger, which has not as yet attained full size, and has not become proficient in the art of swimming with its velum. In the course of a few hours it will have reached the normal size, and will have taken on the attributes of a true veliger.

The straight-hinged quahaug veliger, except for the absence of a flagellum, is similar in every way to the young scallop of this stage. In fact, the majority of lamellibranchs, except *Anomia* and a few others, pass through the period of the early veliger practically identical in form and habits, so much so that it is impossible to differentiate between species. The first traces of individuality are found in the late veliger, in which each species develops a shell peculiar to itself. For this reason the reader is referred, for a detailed description of the early veliger stage, to the report on the scallop (*Pecten irradians*), as only a summarized account is here given.

The veliger stage may aptly be compared to childhood, placed as it is between embryonic development and the attachment stage or youth. Not until this point in its life does any important increase in size occur. This period is divided into two parts, which are styled, for want of a better title, (1) the early and (2) the late veliger, as several anatomical changes differentiate the two. The veliger derives its name from the

peculiar swimming organ or *velum,* which during the first part of this period is one of the most important organs of the animal. With the development of the foot, which takes place toward the last part of the veliger stage, the velum gradually disappears, while the foot, for a brief period, performs its work. The duration of the veliger period depends largely on the temperature of the water, ranging from six to twelve days, during which the veligers can be taken in numbers in the water by means of the plankton net. When swimming in the aquarium they are sensitive to a sudden jar which causes them to pull in the extended velum and settle to the bottom. This circumstance makes it possible to separate the veligers from other plankton forms. The act of swimming is accomplished by the extension of the velum or ciliated pad, the lashing of the cilia propelling the animal in any direction. The entire veliger stage is passed as a swimming larva in the water, occasionally settling to the bottom, where it runs the risk of destruction. It is only brought to an end by the increasing size of the animal, the loss of the swimming function of the foot, and the acquirement of alternate powers of attachment and crawling.

The chief characteristics of the early veliger are: (1) an equivalvular shell with a straight hinge line; (2) a velum or ciliated swimming organ; (3) a primitive mouth lined with cilia, leading into a cavity in the center of the body, the stomach, and an abbreviated intestine with posterior anal opening; (4) an inconspicuous mantle; (5) two adductor muscles. The late veliger is characterized by (1) a shell marked by prominent umbones, directed posteriorly; (2) a well-developed foot, with byssal gland, which has taken the place of a degenerate velum; (3) a more complex digestive tract, with palps and coiled intestine; (4) a conspicuous mantle; (5) two adductor muscles and several primitive gill bars.

The change in the transition between these two forms is quite pronounced as regards: —

(1) *Shell.* — The straight hinge line of the common ancestral form gives way to one of slight curvature by the bulging of the valves to form the umbones. Both valves are of equal curvature, and the embryonic shell has a homogeneous texture which differentiates it from the succeeding growths.

(2) *The Velum.* — The swimming organ, situated within the anterior part of the shell, consists of an elliptical pad, with a border of lashing cilia, capable of extension and contraction, whereby it can be thrust out of the shell or withdrawn quickly by means of muscle fibers attached near the hinge. When contracted the ciliated edges fold inward. The velum is a modification of the anterior ciliated portion of the trochosphere larva. During the middle and last part of the veliger period a degeneration of the velum, with a simultaneous development of the foot, takes place. The growth of a muscular foot seems gradually to obliterate the velum, which can be seen in different stages of

degeneration, the foot with ciliated tip finally assuming the swimming function of the velum.

(3) *Gills.* — Several ciliated V-shaped filaments, capable of extension and contraction, arise on each side of the foot, and eventually become the complicated gills of the quahaug. A thin mantle, closely lining the sides of the shell, similar to the mantle of the adult, is noticeable, while the digestive tract has enlarged in size and length, the straight intestine becoming coiled.

At the beginning of the veliger period we find an animal anatomically equipped to lead a free-swimming life in the water, as is evidenced by its size, shape, lightness of shell and large swimming organ. At the end of this state we find the animal on the verge of another great change. Its free-swimming days are over, and anatomical changes have taken place which fit it to enter upon a new existence, that of youth. The ciliated swimming organ has been replaced by a long muscular foot, which at first enables the animal to swim through the water, but soon loses that power. The shell has changed in size, form and weight, while the soft parts have enlarged to such an extent that further shell growth of a more substantial nature is required. In brief, its free-swimming existence is ended, and, following the invisible law of nature, the structure of the animal has become altered, in preparation for a change of life.

The Attachment Stage.

The attachment of the quahaug marks the end of its embryology and the beginning of its real life under practically the same conditions which surround the adult. The change is accomplished by the development in the foot of a byssal gland which secretes a fine, tough thread, anchoring the animal to any object, particularly sand grains. The method of attachment is described in detail under "The Habits." There is some reason to believe that a crawling stage intervenes between the free-swimming and the attachment periods. If so, it is of slight duration, as the functions of crawling and attachment are supplementary, the welfare of the young quahaug depending both on its resting and its migratory powers. At all events, the time of attachment marks the appearance of a new growth, comparable to the dissoconch shell of the scallop as opposed to the prodissoconch (embryonic shell), which forms the true shell of the adult.

From this time on the changes in anatomy and habits are very similar in the quahaug and the soft clam (*Mya arenaria*), as the environment of both is the same. The habits of the young quahaug are described later, and only the changes in structure will be given here. Specimens for study were obtained from spat collectors, in the form of boxes, which were lowered from a raft in the Powder Hole, Chatham, Mass.

The Shell. — The new growth is sharply separated from the embryonic shell by a definite growth line, and is distinguished by different shell formation, as regards texture, color and lines of growth. The embryonic shell has a smooth homogeneous structure, with fine concentric lines of growth, whereas the new growth is coarser, whiter and characterized by concentric ridges occurring at definite intervals. The color is evidently due to the greater amount of lime salts. The ridges (Fig. 28) are especially prominent in rapidly growing quahaugs less than 1 inch in size, and can be observed on well-preserved adult specimens, where the umbones have not worn away. They reach their maximum size when the quahaug is about ¾ of an inch in length, varying greatly in prominence on the same and different specimens. In quahaugs 1 millimeter in size as many as twelve distinct ridges could be found. No explanation for these prominent lines can be given. In quahaugs ¾ of an inch in size they appear at the rate of two to three a month during the summer, apparently at regular intervals, as the amount of space between ridges seems to depend upon the rapidity of growth. These ridges differentiate the very early stages from *Mya arenaria*, which at first has a round form, different from the elongated adult. Both valves are equal and have prominent umbones, back of which appear faint lunules, the heart-shaped structure so well marked on the adult quahaug. Unlike the young scallop, no byssal notch is present.

The Soft Parts. — At the beginning of the attachment stage the animal has all the organs characteristic of the adult in miniature form. The visceral mass and sexual organs are not conspicuous, the foot is more mobile and relatively larger than the plow-shaped structure in the adult, the byssal gland, absent in the adult, is a conspicuous appendage of the foot, and the other organs, differing in size, position and development, are but rudimentary. As the quahaug increases in size these organs take on adult characteristics, and by the end of the attachment period (size, 9 millimeters), they conform in practically every detail with the adult.

(1) *The Mantle.* — The mantle appears larger than that of *Mya* (soft clam), and is pressed into a series of folds at the free margin, which gives the appearance of a number of large knobs or tufts. In the young the margin is ciliated and sensitive to touch, but in form it differs little from the adult, which apparently has maintained the primitive lamellibranch mantle.

(2) *The Siphon.* — The mantle edges at the posterior end of the young quahaug, almost at the beginning of the attachment stage, are modified to form the excurrent and incurrent siphons, which constitute the "neck." The siphon is very similar to the same structure in the clam. The excurrent part has the same filmy telescopic attachment (Fig. 29) which draws in and out with a folding motion. When a stream of water is shot out, the transparent tube is cautiously unfolded and held as a hose to direct the flow. The average time of

expansion was found to be four seconds, the time of contraction varying from two to eleven seconds. In crawling, there appears to be a certain degree of unison between the outflow of water and action of the foot which may assist the progress. This excurrent attachment gradually disappears as the quahaug grows older, although in one-half or three-quarter inch quahaugs a remnant can be observed on the edge of the excurrent siphon. The edges of the siphons are lined with tentacles, as this is a most important sensory part of the mantle, the incurrent siphon having about three times as many as the excurrent. In a 1-millimeter quahaug twelve tentacles were counted on the incurrent and four on the excurrent siphon, a greater number than on a clam of the same size. These large tentacles are probably of greater use as sense organs to the young quahaug than to the old. Very little color is found on the mantle and siphon, except on the tentacles, which sometimes are strongly pigmented.

(3) *The Foot.* — The early foot is a muscular body, capable of an extension equal to two-thirds the length of the shell. At the tip the cilia are somewhat longer, possibly aiding in the strong grip which is exerted at this point, enabling the quahaug to crawl along a surface. On each side of the foot is a circular otocyst or balancing organ. On the ventral side of the foot projects a papilla with a deep cleft, the byssal gland. It is more prominent than the byssal gland of the scallop.

(4) *The Gills.* — The few simple filaments of the veliger stage increase in number, forming the inner gill, while new buds repeat the same process to form the outer. As the gills enlarge they become more complicated, taking on adult characteristics.

(5) *The Muscles.* — The two adductor muscles remain in the same position, enlarging in proportion to the amount of increased work.

(6) *The Reproductive Organs.* — The visceral mass is formed above the foot, and is not visible until toward the last of the attachment stage, when the foot becomes relatively smaller and less motile. In this body are the ovaries or testes, according to the sex of the quahaug.

(7) *The Digestive Tract.* — The liver, arising by two ducts from the side of the stomach, enlarges rapidly and takes on a dark brown color. The intestine increases in length by forming tortuous coils in the visceral mass, and after piercing the ventricle of the heart, terminates behind the anterior adductor muscle.

THE HABITS.

A study of the habits of any animal frequently leads to the discovery of facts which can be utilized for practical purposes. In the case of the quahaug at least three habits are directly related to artificial cultivation: (1) the method of attachment, which furnishes possibilities for spat collecting; (2) the non-migratory life, which makes planting

possible without enclosures; (3) the method of feeding, which suggests the probability of increasing the rate of growth, fattening and even producing special flavors. In addition, notes upon other topics are presented, such as enemies and environment, which do not properly come under the definition of habits, but to a greater or less extent influence the life of the quahaug. As far as possible these subjects have been arranged in accordance with the development of the animal.

Attachment.

Attachment takes place at the end of the veliger or free-swimming stage, when the young quahaug fixes itself to various objects by means of a horny thread called the byssus (Fig. 28), secreted from a gland in the foot. The objects of attachment are sand grains, shells, boxes, eelgrass, sea lettuce, etc. The period of fixation marks the change from an active swimming existence to a more sedentary mode of life. The gland which secretes the byssus in most lamellibranchs is situated in the ventral side of the foot, and varies in size and appearance. Lining the sides of this gland, which has the appearance of a pore, are a number of little cells which furnish a mucus-like secretion which, when coming in contact with water, immediately hardens, forming tough threads of conchiolin, a complex chemical substance of horny nature.

The byssus in the different lamellibranchs has a variety of forms. In some it consists of a number of soft glossy threads bundled together, as in the young of *Pecten,* the scallop; in the mussel (*Mytilus*), where it is an important organ of the adult, there is a thick bundle of hair-like threads with disks at the ends which are attached to the object of support; *Anomia,* the silver or jingle shell, has a calcareous byssus which projects through the lower shell and strongly attaches to the animal; and in the young of the soft clam (*Mya arenaria*) it consists of a single translucent thread with several branches. In the mussel the byssus in the adult has no connection with the foot, but is situated behind it, forming an almost permanent attachment for the support of that mollusk. Nevertheless, the mussel is reported to be able to move along slowly by the formation of new threads and the destruction of the old strands (Williamson, 13). Certain lamellibranchs seem to have lost the byssus through disuse, some apparently never possessing this organ at any stage of their development. Another class retains the byssus for certain periods, *e.g.,* the clam, which makes use of the power of attachment until it reaches a size capable of burrowing deeply in the sand, and the scallop, which throughout its life retains the power of byssal fixation, but does not use it to any extent after the first year.

The adult quahaug possesses no byssus as it has no need for that organ. For a long time there has been considerable question as to whether the quahaug in its early life possessed such an organ. Ryder (12) in 1880 found that the young of the soft clam were attached by a single branching thread to seaweed and sea lettuce. This fact was

clearly demonstrated by Kellogg (4) in his report on the "Life History of the Common Clam," in which he gave some excellent drawings of the byssal attachment, and proved that the attachment stage was a necessary part of the life of the young *Mya*. At this time it was surmised that the quahaug likewise had a byssus during the early part of its existence. Proof was first obtained September, 1906, when it was the good fortune of this department to record the attachment of young quahaugs (*Venus mercenaria*) in the spat boxes at Monomoy Point.

The byssus of the quahaug is in appearance so similar to the same organ in the soft clam that if it were detached a person could not tell the two apart. In use, structure and formation the two threads are exactly the same, so that, in describing the attachment of the quahaug, use is made of facts recorded for the clam by Kellogg (4). The byssus consists of a single thread, normally from 1/4 to 1/2 an inch in length, but so elastic that it can be stretched to a length of 1 1/2 inches without breaking. Several branches, usually not more than two or three, extend from the lower part of the thread, and at their distal ends divide into strands like the delta of a river, which spread out on the foreign object, fastening themselves apparently by little suckers or stickers. The thread is of uniform thickness, except at its distal end, where it is slightly finer. Under the microscope the thread has a translucent glossy appearance, similar to strands of prepared gelatine.

The quahaug first attaches itself at the close of the veliger or free-swimming stage, when a prominent byssal gland is formed on the ventral side of the foot. The quahaug retains the power of attachment until it has attained a size capable of burrowing firmly in the sand. The largest quahaug observed with a byssus measured 9 millimeters, and was found in a spat box at Monomoy Point, Oct. 13, 1906.

Many observations on the byssal attachment of the quahaug were made at Monomoy Point, where the quahaugs were obtained in spat boxes suspended from a raft. The attached quahaugs were observed here during August and September in 1906 and 1907, and in 1908 as early as July 24. The majority of these quahaugs were buried in the sand and attached to the sand grains by the byssal threads. Occasionally a quahaug was found attached to the sides of the box out of the sand. At Wellfleet small quahaugs were found attached to the shells put down for the capture of oyster spat, and many times quahaugs were raked up adhering to shells and other material. Likewise young quahaugs were frequently observed to attach themselves to the glass dishes in which they were kept for study in the laboratory. These observations show that, while the majority settle in the sand, the quahaug can "set" on objects such as shells, boxes, eelgrass and sea lettuce, and in the latter cases can be carried such distances as described for the soft clam by Kellogg (4). Thus, the quahaug is comparable with the clam, which "sets" both out of and in the sand. Practically all the quahaugs attached out of the sand were between

2 and 3 millimeters in size, no large ones being observed, which indicates that the quahaug "sets" but temporarily out of the sand.

The time of spinning a byssus is comparatively short. No direct observations have been made on this point; but it has been known to break the old and form a new one within a few hours. It is doubtless a much shorter time, as the young scallop has been seen to spin a similar byssus in three minutes.

The process of attachment has not been studied. In general the embryo, swimming with its foot, strikes a surface, presumably catches hold with its foot, and, after crawling to a suitable place, spins its byssus. In other cases it strikes some object, and closing the shell drops to the ground, where it passes through the same process, only attaching itself to the sand grains. The young quahaug has the power to cast off the byssal thread at will and spin another. The thread separates from the animal at the byssal gland and remains clinging to the object to which it is attached. This is probably of constant occurrence, especially with the smaller quahaugs, as they are quite active at this stage, and in traveling from one resting place to another must repeatedly break the thread and quickly spin another. At this period the animal alternately leads a traveling and a sedentary existence.

Unquestionably the byssus is of importance to the young quahaug, as otherwise this organ would have degenerated from disuse. Primarily the function is protective, as it enables the animal, though of small size, to remain in the sand, and prevents its being washed from its shallow burrow. Again, in the earlier stages the attachment to various objects keeps the young quahaug from being smothered in silt, or from being washed ashore to its destruction. Attachment is needed only until the quahaug obtains sufficient size to protect itself by burrowing more deeply in the sand. The slender thread though small is unusually strong, resisting a considerable pull before it parts, and can be considered as the anchor cable which moors the quahaug.

The "Set."

The time of "set" varies, as it depends upon the spawning season. Usually the young quahaugs are noticed slightly later than the young scallops. At Monomoy Point, in the raft spat boxes, small quahaugs have been observed by the naked eye as early as July 24, in 1908, while in other years they have not been recorded until the second week in August. The "set" is not abundant, as is the case with the clam, and no quantities of young quahaugs comparable to the heavy "sets" of small clams are found. The fact that the "set" is usually below the low-water mark perhaps explains the failure to find thickly "set" areas, as many beds escape the attention of the quahauger. As it is, but few localities of heavy "set" are known. At the present time the Acushnet River furnishes the greater part

of the small quahaugs, though in some years the Mill Pond in Chatham; Tuckernuck Island, Nantucket; Katama Bay, Edgartown, have also contributed considerably. The Katama Bay region maintains the steadiest supply, owing to the protection of the quahaugs under $1\frac{1}{2}$ inches by the town of Edgartown, while in the case of Chatham and Tuckernuck Island the supply is very erratic. The beds have been depleted, have remained barren for a time and have again received other heavy "sets."

When the first attachment has been made, either to shells or sea lettuce, there is a later migration to the sand, but usually the "set" comes directly on the soil. The nature of the bottom largely determines the future welfare of the "set," which will soon perish if the ground is unsuitable. An excess of silt, slimy mud, shifting sand, proves unsuitable for the existence of the young animal, showing that only portions of the sea bottom are favorable for the existence of the young quahaug.

The same causes which influence the "set" of the soft clam to a large extent determine the abundance of young quahaugs in any locality. Its nature depends largely upon the location in respect to the shores and current, and definite combinations are necessary. As with the soft clam, it has been noticed that the "set" often occurs in an eddy, or on the sides of a swift current. In the Mill Pond at Chatham the "set" is found on the bar reaching part way across the entrance to the upper part, over which the tide sweeps back and forth. A similar case is found at the tip of Jeremy's Point, Wellfleet, and on the gravel bar, over which the tide flows with great speed, large numbers of seed quahaugs can be obtained. In the latter case the bar is exposed at low water during the low running tides.

The quahaug over $\frac{1}{2}$ inch in length is comparatively free from the enemies which attack other shellfish, as its hard shell renders it immune from all except the horse-winkle (*Fulgur caniculatus* and *carica*) and the common cockle (*Lunatia heros* and *duplicata*). Severe winters and other climatic changes affect the quahaug but slightly, except on the exposed flats between the tide lines. So we find in the quahaug an animal which for the greater part of its life is better protected from enemies than the other commercial shellfish. On the other hand, the female quahaug produces the same quantity of eggs as the other shellfish. Therefore, the struggle for existence must be exceptionally severe during its early life or free-swimming period, furnishing a possible explanation for the frequent failure of the quahaug "set."

Spat Collecting.

In the oyster industry the importance of spat collecting became apparent as soon as the natural beds ceased to yield a sufficient amount of seed for planting purposes. In considering quahaug culture the

question naturally arises as to whether there are any artificial means of raising young quahaugs for planting. The importance of having a good supply of seed is apparent. We have previously stated that at present there is no practical method of raising the young quahaug from the egg, owing to its small size and delicate nature. The other possibility is the collection of the quahaug seed from the water by some method of spat collecting similar to that used for the oyster.

When the oyster "sets" at the end of the veliger period it attaches itself by a calcareous secretion to shells and rocks. The quahaug, on the other hand, attaches itself by a single-threaded byssus to sand grains or other clean objects. Attempts were made to catch the quahaug at this stage by spat boxes, — small dry goods boxes, partly filled with sand, — which were suspended from the raft at Monomoy Point. In these boxes quahaugs were obtained at the end of the spawning season in more or less abundance, for the study of the early life history and for the growth experiments. In all probability the young larvæ, when ready to "set," strike the sides of the box and settle in the sand, where they are held in by the sides of the box. Unfortunately, while these boxes proved useful in obtaining quahaugs for experimental purposes, the amount collected was insufficient for commercial purposes. The largest number ever found in one box was 75 per square foot of surface, and the majority of boxes yielded less. To make such a method commercially important it would be necessary to obtain several hundred quahaugs to the square foot of surface. For this reason, unless the essential principles of this method can be applied on a large scale with better success, it is hardly practical to obtain the seed in this way. A better solution would be to develop the places which are naturally suited for the catching of seed by the building of gravel bars, and by artificially directing tidal currents, in other words making nature supply the seed.

Locomotion.

The organ of locomotion for the adult quahaug is the foot, which is described as situated on the ventral surface of the visceral mass in the form of a keel-like projection. Its shape enables the foot to readily enter the sand in the same manner as a plow, so that the animal can turn over, burrow or even crawl through the sand. The foot is composed of comparatively tough muscle fibers, and its action is aided by retractor muscles, anterior and posterior, which are attached to the shell above the fixation of the adductors. As with the soft clam (*Mya arenaria*), the foot is distended by the influx of blood from other parts of the body. The movements of the adult are confined to two forms, (1) burrowing and (2) crawling, the former being the more common.

Burrowing is the act of forcing the shell of the quahaug into the sand below the surface, and is accomplished by the action of the foot. Usually this act is performed when the quahaug lies under the water, but it may be possible for the animal, like the sea clam, to enter the

sand when exposed to the air. The soft clam requires to be covered by water before it can burrow properly. The quahaug, resting on the surface, cautiously extends the muscular foot through the slightly opened valves, working it down among the sand grains until a sufficient purchase is obtained to raise the shell on edge. The shell by a series of jerks is pulled down after the active foot, until the animal is entirely buried beneath the surface, the external openings of the short siphons remaining in view. The length of time depends upon three factors, (1) the size of the quahaug, (2) its activity and (3) the soil. The large quahaugs take longer to burrow, as they are less active, heavier and require more force to enter the sand. The foot is relatively larger in the small quahaugs than in the large, and naturally the young show greater activity in burrowing. Besides age, the activity of the quahaug depends upon the temperature of the water, as below 50° F. they burrow slowly, often lying for long periods on the surface. This is an important fact for the planter, as there is danger in winter planting, owing to the exposure from non-burrowing. The nature of the soil, whether compact or loose, hard or soft, determines to some extent the rapidity of burrowing. When conditions are favorable, burrowing is usually accomplished within a few minutes. Out of 1,500 quahaugs planted at Monomoy Point in sixteen different lots on June 4, 1906, and Oct. 10, 1905, when the water was about 62° and 55°, respectively, 92 per cent. had burrowed within twenty-four hours after planting. The quahaugs were small, less than 41 millimeters, and in good condition. The June beds gave 94 per cent., the October beds 85½ per cent., showing the effect of temperature.

The power of burrowing is necessary for the quahaug in the same way as for the soft clam. Whenever the animal is forced or torn from its burrow by natural or artificial agencies it can again resume its natural position in the soil.

The quahaug also possesses the power of crawling, as it is equipped with all the necessary organs for progress through the soil, but does not make use of this faculty to any great extent. The act of crawling is accomplished in much the same way as the burrowing, which is a modification of the original crawling habits of the young. After burrowing in the soil the animal works the extended foot forward, forming a way for the shell, which is pulled after the foot. The movement is anterior, *i.e.*, the siphonal end of the animal brings up the rear, the end of the shell projecting so that a winding trail is left on the surface of the sand, showing the course of the animal. Crawling is effected by the same conditions which influence burrowing, such as temperature, soil and size of the quahaug, the older animals moving very little, while the young forms are more active. In one instance a blunt quahaug between the tide lines was found to have crawled 7 inches in twenty-four hours. All movements in this bed were in the direction of the retreating tide. While crawling is more often observed between

the tide flats, it also takes place in the natural habitat, below low-water mark. On wet flats the quahaug can possibly crawl without water over it; but most of the crawling is done under the water.

Various writers have referred to the quahaug as wandering between the tide lines, as if the animal were constantly moving from place to place. In reality the quahaug moves but little, and usually at a slow rate, as by force of habit it is a stationary animal. The writer several times has observed its wanderings, as shown by the marks on the tidal flats, but has never found evidence of its traveling any great distance. On the other hand, from general observations and from planted beds which were left for years, he has invariably found that the quahaugs remained in the same localities where placed. Even the smaller, active quahaugs, ¾ of an inch, which are more prone to crawling, have been observed to remain where planted. Kellogg (2) in 1903 was the first to note that there was practically no migration of the quahaugs in his beds, which he found intact several months after planting. All our growth experiments substantiate Professor Kellogg's observations, as in no case was there any general migration. Therefore, it can be concluded that, while the quahaug has the power of moving, possessing as it does the necessary organs for crawling, it makes use of this habit but little, and when placed on satisfactory bottom will remain within a few feet of its original position. The importance of this fact to planters should not be overlooked, as otherwise the prospective culturist will be afraid that his planted crop may move. Such is not the case, and the culturist need never fear any appreciable loss through migration.

The proofs on which the above conclusion is founded are three: (1) observations on many growth experiments; (2) experiment on movement below low-water mark; (3) experiment on movement between the tide lines.

(1) The facts on this point have already been given. In all the growth experiments the quahaugs were found a year or more later in the immediate vicinity. In no case had there been any marked migration. In several beds, planted between the tide lines at Monomoy Point, which were taken up eleven months after planting, nearly all the quahaugs were found within 3 feet of the original beds. In one bed the quahaugs were of small size, measuring 17 millimeters in length, showing that even the young, active animals were not inclined to wander.

(2) A means of roughly determining the migratory powers of the quahaug was tried at Monomoy Point in 1906. Short stakes, in width and thickness 3 inches by 1 inch, were driven in the coarse sand in the Powder Hole in front of the laboratory, where there were 2 feet of water at low tide. Six quahaugs were placed in order around the stake, 1 at each end, 2 at each side, with the tips of their shells just

touching the wood, so that any movement could be readily determined. Four lots of 6 quahaugs each, measuring 28, 29, 40 and 41 millimeters, were placed in position Sept. 14, 1906, and examined three times, at intervals of three, fourteen and thirty-eight days, respectively, at each examination the quahaugs being left where found, so that the final observation recorded the total movement for the entire period. On the first examination after three days 5 quahaugs out of the 24 had moved from their original position, moving from ½ to 3 inches, on an average of 1 inch. In fourteen days 8 more, 13 in all, had moved, the average distance this time being 1.27 inches, the minimum distance traveled being ½ inch and the maximum 3 inches, while 1 quahaug was missing. After a period of thirty-eight days 4 were reported missing, 5 remained as originally placed and 14 had moved an average of 2.15 inches, with a minimum of ½ inch and a maximum of 6 inches. What became of the 4 missing quahaugs was not determined, and it is a matter of conjecture whether they crawled away or were washed out of their burrows in the sand. The distance covered by the 15 that moved is very slight and unimportant. If the quahaug were naturally a migratory form, as the sea clam, within thirty-eight days all would have traveled away; but considering the fact that 83 per cent. of the number remained within a few inches of their original position, it can be concluded that the quahaug leads practically a sedentary life. No difference was noticed in the movement of the 28-millimeter and the 41-millimeter quahaugs, as the number of large and small which moved were about the same, although the larger quahaugs covered about twice as much distance as the small. A parallel experiment with sea clams (*Mactra solidissima*) was conducted under the same conditions, with the result that all disappeared in the course of a few days after planting.

(3) A similar experiment was tried between the tide lines at Monomoy Point, on a sand clam flat. Five stakes were driven in the flat, and quahaugs were planted close to these on Sept. 18, 1906. One month later all but 1 out of 57 quahaugs were found within 6 inches of the posts, showing that, even between the tide lines, the so-called wandering zone, the quahaugs showed no tendency to migrate.

Movement of the Young Quahaugs.

(1) *Swimming.* — The swimming period of the quahaug's life lasts during its embryonic existence, ending soon after the completion of the veliger stage, although the footed larva has for a short period the power of swimming with its muscular foot. The embryo acquires the power of moving through the water at the age of ten hours, when the surface cells are equipped with minute hair-like processes, cilia. The early movements consist of random revolutions of a spiral nature. Two hours later, definite direction is established by the elongation of

the animal, which now swims with a spiral movement, rotating around the longitudinal axis. With the growth of the embryonic shell, about thirty-six hours after fertilization, the animal, now called the veliger, swims by means of the velum, a muscular pad covered with long cilia. The velum has been derived from the anterior ciliated area of the ciliated larva. The animal opens its shell, thrusts out the velum, and is propelled by the action of the cilia in any direction. During the summer spawning months the water is full of these small veligers, which can be taken by a plankton net of silk bolting cloth. When startled, as by a sudden jar, they cease swimming, pull in the velum, close the shell, and settle to the bottom. During the veliger stage occurs the loss of the velum and the appearance of the foot, which takes its place, at first as a swimming, later as a crawling organ. Swimming is accomplished through a kicking movement of the foot, which propels the animal through the water. A similar movement has been seen in adult razor clams, which have been observed to swim through the water for short distances by the kicking with the long foot.

(2) *Crawling.* — With the young quahaug crawling is somewhat different than with the adult, and is similar to the crawling of the young clam. Observations were made on quahaugs from 2 to 3 millimeters in size. At this age the flexible foot is elongate, and more like the blade of a knife than the keel-shaped foot of the adult. Two methods of crawling were observed.

(*a*) *The Forward or Following Movement.* — The forward movement is the common means of crawling, and is similar to the methods observed in the young clam and scallop. It consists of extending the foot and dragging the body after it, in the same manner as the adult quahaug moves through the sand. Fig. 20 shows the foot just appearing from the shell. The mantle and siphon are extended, while the angle between the shell and the foot is acute. This is the beginning of the movement. Fig. 21 shows the foot extended to its full length. It has made a twist so that the bottom part of the ciliated tip can get a firm hold. By straightening out this twist the shell is raised on edge to its natural position when in the sand. The usefulness of this movement is explained by the fact that the quahaug, when exposed, lies flat on the surface of the sand, and that the shell is thus raised on edge, so that it can enter the sand with a cutting edge. The next movement (Fig. 22) is what might be styled a "downward tip," as this action is likewise of use in entering the sand as a wedge. Then quickly follows an upward tip (Fig. 23). By these two tips the quahaug has withdrawn within the shell all but the extremity of the foot, and is now ready for another start. The distance covered is three-fourths the length of the foot. The two tips are caused by the retractor muscles of the foot. In the downward tip the anterior retractor pulls on the anterior portion of the foot, resulting in the downward tip to the anterior portion of the shell, and the second or

upward tip is the result of a similar action of the posterior retractor. A 3-millimeter quahaug was observed to travel at the rate of an inch, over eight times its length, in two minutes, covering about 1/17 of an inch at each movement, the average time of each movement being about seven seconds.

(b) *Backward Movement.* — The young quahaugs make use of another method of crawling, though less frequently than the first. This movement resembles a kick, and sends the shell backwards or sidewise. In Fig. 24 the foot is turned under the shell until the tip finds a resting place. Then by a jerky motion the shell is raised from the bottom and hurled to the position of Fig. 25 by a direct backward thrust. The foot is then drawn in and the same performance repeated. Sometimes the shell rests on the same valve, sometimes it is turned over so that on the completion of the movement it rests on the opposite side (Figs. 26 and 27). There is a similarity between the forward and the backward movements as they both depend upon the contraction and the expansion of the foot, but they differ in the application of the force, the first being a pull and the second a thrust. The average of 12 cases observed gave six seconds as the time consumed from start to finish by this movement, as compared with seven seconds for the other. The longest time observed was ten seconds, the shortest, four.

It is interesting to note that while in the case of the scallop a direct relation can be noted between the expulsion of water from the siphonal region and locomotion, in the case of the quahaug such cannot be definitely established. Possibly there may be a slight aid during the forward movement, although the flow of water is not co-ordinated with the contraction of the foot, as with the scallop. In the backward movement there is no assistance whatever.

(3) *Rate of Crawling.* — The following observations were made on the distance traveled by small 2 and 3 millimeter quahaugs. Small round glass dishes 1⅝ inches in diameter, were partly filled with fine white sand. Two quahaugs 2 and 3 millimeters were put in the center of the dish, which was placed in the aquaria. On examination fifteen minutes later it was found that the 2-millimeter quahaug had traveled 32 millimeters, or sixteen times its own length, *i.e.*, the rate of 5 inches per hour. The first 23 millimeters were through the sand, the last 9 on the surface. On a second examination, one and one-half hours later, the quahaug had only traveled 10 millimeters more, this time under the sand. The 3-millimeter quahaug had not moved at all, remaining in the position originally placed in the sand.

Three other quahaugs, 2 millimeters, 3 millimeters and 3 millimeters in length, respectively, were placed in a dish 3 inches in diameter, filled with white sand. Examined six hours later, they had moved 11 millimeters, 26 millimeters and 100 millimeters, respectively.

Recovery from Injury.

In several cases the shells of the quahaugs have been broken in planting. Unless the break or crack is too large the wound will heal by the formation on the inside of a new layer of shell, the old crack never joining, but merely being held together by the new growth underneath. It is well for the quahaug culturist to know that slight breaks are not always fatal to the quahaug, and that, in planting, broken ones should not be discarded.

The Feeding Habits.

The food of the quahaug, as of all the lamellibranch mollusks, consists principally of diatoms, — minute plant forms which are found in all waters. These little plants vary greatly in size and shape, often the species of one family but faintly resembling each other. Their chief characteristic is a silicious case, which distinguishes them from other plankton forms. The marine diatomaceæ are somewhat different from the fresh-water forms, but maintain the same general family characteristics. They are abundant throughout the water, although the lighter and smaller forms are most numerous near the surface. These surface species are naturally of less food value than the large, deeper forms. On the various soils which constitute the bottom, the diatoms are constantly reproducing and adding to the supply in the water. It has been found that mud furnishes better breeding places than sand, and that the color of certain surface soils is often due to the kind of diatomaceous growth. An increase in the temperature of the water results in more rapid reproduction. Other minute forms of plankton life are ingested by the quahaug, unless they are too large, in which case, by a complicated mechanism of the ciliary tracts, they are discarded with silt and other foreign material. In this way the quahaug shows a selective power in feeding. Small crustaceans, larvæ of mollusks and crustaceans, protozoa, rotifers, bacteria, etc., constitute a part of the quahaug food, the quantity depending on the location and the season.

The following account is taken from the work of Prof. James L. Kellogg, who has ably described the feeding habits of the quahaug in his report upon "The Feeding Habits and Growth of *Venus mercenaria.*" The subject-matter is presented in condensed form, as only the important features are given. From the previous description of the anatomy the reader will remember that just inside the shell lies the mantle, enclosing the body in a fleshy case. Posteriorly the mantle lobes are fused to form two tubes, the incurrent and excurrent siphons, through which a steady stream of water enters and leaves the mantle chamber. Suspended in the mantle chamber, on each side of the visceral mass,

are two conspicuous folds, the inner and outer gills, which play an important part in the collection of the food. On each side of the mouth, which is on the median line behind the anterior adductor muscle, are the palps, which are similar in appearance to the gills and function in conducting food to the mouth.

We have seen that a constant stream of water entered the mantle or branchial chamber. What becomes of it? And what is it that causes the current? All of this water in the mantle chamber streams through the minute openings between the filaments of the gill and enters its interior space. It now rises to the base of the gill, and flows into a tube, the epibranchial chamber, through which it passes backward, leaving the body by the upper or exhalent siphon, which is directly continuous with the epibranchial chambers of the four gills. The currents which we first noticed, then, enter the mantle chamber by the lower siphon, pass into the interiors of the four gills, flow to their upper or attached edges, and are directed backward and out through the upper siphon tubes of the mantle.

The cause of these rapid currents is revealed by a microscopic examination of the rods or filaments of the gills. These are found to be covered on their outer surfaces, which face the water on both sides of the gill, with innumerable short, hairlike structures which project perpendicularly from the surface. These cilia are protrusions of the living protoplasm of the cells which form the walls of the filaments. Each possesses the power of movement, lashing in a definite direction, and recovering the original perpendicular position more slowly. This movement is so rapid that it cannot be seen till nearly stopped by inducing the gradual death of the protoplasm. It is very effective in causing strong currents in the surrounding water.

A microscopic examination, and direct experiment with minute, floating particles, will show that other cilia are present on the filaments than those which cause the water to enter the gills. The diagrammatic figure of the gill does not show why the minute food particles may not be taken into the interior of the gill by the entering stream of water, and finally out of the body through the broad water channels. This is prevented by long cilia arranged in bands, which project out laterally between contiguous filaments in such a way as to *strain* the water which enters the gill, thus preventing all floating matter from entering. These highly specialized cilia tracts of lamellibranch gills I have called the "straining lines." In some forms there is a single line, in others there are two. In some cases the lines are formed by a single row of cells; or a section across the line sometimes reveals several closely crowded cells bearing the greatly elongated straining cilia.

That foreign matter is really excluded as the current of water enters the gill, may be demonstrated by direct experiment on a living gill. Carmine may be ground into a fine powder, and suspended in water without becoming dissolved. If a small amount of this is allowed to fall on the surface of a living gill, it will be seen to lodge there. A wonderful thing now occurs. A myriad of separate minute grains, which may represent the food of the clam, are almost instantly cemented together with a sticky mucus which is secreted by many special gland cells in the filaments, and the whole mass,

impelled by the oscillations of the cilia, begins to move with some velocity toward the lower or free edge of the gill. On this free margin is a groove into which the material collected on the faces of the gill is turned. This groove is also lined by ciliated cells, and the whole mass is swept swiftly forward in it toward the palps. The natural food of the clam, of course, is carried forward in the same way. It is evident that a large proportion of the organisms floating in the water which enters the mantle chamber must come in contact with the sides of the gills, and be carried forward to the mouth folds, to which they may be transferred. . . .

If we now examine the palps with a hand lens, we may notice that their inner surfaces — those nearest to the mouth — are covered by a set of very fine parallel ridges. They are capable of many movements. They may be bent and spirally twisted, lengthened or shortened, and, if their inner faces touch the edges of the gills, any material which is being brought to this region is transferred onto the ridges of the palp. This is accomplished by strong cilia which are developed on the ridges. These same cilia carry the foreign matter on across the ridges, and finally force it into the mouth.

Enemies.

The adult quahaug is well protected from enemies by its hard shell, while the young larva is at the mercy of both the natural enemies and adverse physical conditions, which make its existence most precarious. We can divide the enemies of the quahaug into two classes: (1) the enemies of the young; (2) the enemies of the adult.

Enemies of the Young. — Adverse natural conditions, rather than active enemies, destroy vast numbers of the quahaug larvæ. Up to the time of attachment the young quahaug is at the mercy of tide, wind, changes in temperature, cold rains, etc., which either wash it ashore or kill the delicate embryo by sudden changes. All manner of fish, crustacean and molluscan life feed on the larvæ, even the mother quahaug sucking down her own offspring. The young quahaug must "set" on good ground or perish. In this way nature has regulated the number of eggs in the individual quahaug so that the large number compensates for the great destruction. Even when the quahaug has "set" it is not free from enemies. It becomes the prey of ducks and other water fowl if it happens to settle in shallow water. While no actual instances have come to the notice of the writer of taking quahaugs from the crops of water birds, other small shellfish of a similar nature, although adults, have been found. If these mollusks were eaten, it is possible that the small quahaugs would also be taken. Such mollusks as *Lævicardium mortoni* and young razor clams (*Ensis directris*) have been found in the stomachs of flounders, and naturally small quahaugs could be taken in the same manner by bottom-feeding fish. Instances have been recorded where small quahaugs have perished by washing ashore in storms, showing that even when protected by a shell they are at the mercy of the elements. Starfish, particularly

the young "star," probably prey upon the young form, and it is possible for the oyster drill to attack a small quahaug.

Enemies of the Adult. — The enemies of the adult can be grouped into two classes, — the active and the passive. The active enemies are given in order of their importance: (1) man; (2) the winkle or cockle (*Lunatia duplicata* and *heros*); (3) the conch (*Fulgur caniculatus* and *carica*); (4) the starfish. The passive enemies are those which feed on the same forms as the quahaug, in certain cases depriving it of its sustenance, in others hindering its growth. As such may be enumerated mussels, other shellfish of no economic value, seaweeds, etc.

(1) *Man.* — It is hardly necessary to more than mention man as the greatest enemy to the quahaug, because this report has shown in numerous ways, especially in the historical review of the fishery and the description of the quahaug beds, how man, through excessive digging, has gradually reduced the natural supply. It need scarcely be stated that, unless some method of culture is inaugurated within the next few years, the quahaug industry will become commercially extinct through overfishing by man. Man has overthrown the balances of nature both by ill-advised methods of overfishing and by changes in conditions through the pollution of the streams and waters. Man is and will be the greatest enemy of the quahaug unless he repair the damage already done and assist nature in renewing the supply.

(2) *The Winkle.* — The common bait winkle or cockle (*Lunatia heros* and *duplicata*) attacks the quahaug by perforating its shell in the region of the umbo by means of a rasping tongue armed with sharp teeth. The animal drills a clean countersunk hole from 1 to 6 millimeters in diameter, according to the size of the cockle. While the chief prey of the winkle is the sea clam, it will frequently attack both the quahaug, especially the "little neck," and the soft clam. Owing to the thick shell the quahaug is more immune than the sea clam, as it takes the winkle much longer to pierce the shell and suck out the contents. At Monomoy Point numbers of quahaugs were killed by the winkle in the experimental beds. In nearly every case, although variations have occurred, the perforation was made directly on the projecting umbo or beak of the quahaug. Although the winkle, with the exception of man, is considered the greatest active enemy of the quahaug, it can be readily prevented from injuring the quahaug beds by a little care on the part of the culturist. The cockle never appears on the quahaug grounds in such numbers that it is impossible to gather them, and owing to the high price of these snails for bait, \$3 to \$4 a bushel, it is highly profitable for the quahaug planter to capture them for the market, at the same time preventing damage to his quahaugs.

(3) *The Horse-winkle.* — The extent of the damage caused by this large gasteropod mollusk cannot be determined, and possibly may be

greater than the destruction by the cockle. The oystermen claim that large numbers of oysters and quahaugs are destroyed by the horse-winkle. The method of attack, which has not been studied by the writer, is aptly described by Colton (14), who states that quahaugs are eaten in from seven hours to three days; that the meals are far between, and that the winkles spend their time between meals buried in the sand. The method of attack is described as follows: —

> The conch (*Fulgur perversa* or *F. carica*) grasps the *Venus* in the hollow of its foot, bringing the margin of the *Venus* shell against its own shell margin. By contracting the columellar muscle it forces the margins of the shell together, which results in a small fragment being chipped from the shell of *Venus*. This is repeated many times, and finally the crack between the valves is enlarged to a width of 3 millimeters or more.
>
> The proboscis is normally about 5 millimeters to 8 millimeters in diameter. There are three ways in which it may get at the animal. First, it may flatten out its proboscis so that it will go through the crack; secondly, it may pour in a secretion between the valves which kills the clam; and thirdly, it may wedge its shell between the valves of the *Venus*, and by contracting the columellar muscle actually wedge the valves apart.

(4) *The Starfish.*— The starfish is the least effective of the four active enemies of the quahaug, as it is not able to readily attack the quahaug in its burrow. A large starfish, which was found in one of the experimental boxes at Monomoy Point, had eaten a number of the quahaugs which were buried under the sand. The starfish evidently was able to get at the animals by working its "arms" in the coarse sand until the quahaug was exposed, and then opening it in the same manner as the oyster, by the steady pressure of the tube feet on the two valves of the quahaug. Quahaugs lying outside the sand are rapidly devoured by the starfish, which, after forcing the valves apart, passes its everted stomach into the shell and digests the contents. Under natural conditions it is probable that little damage is accomplished by the starfish, owing to the difficulty of getting at the quahaugs.

QUAHAUG CULTURE.

The Decline.

For decades the tidal flats and waters of the seacoast have yielded valuable harvests of shellfish, and the free-fishing public have continued their campaign of spoliation under the impression that these fertile territories were inexhaustible. As the thickly bedded areas near the beaches were exhausted, the quahaug fishermen ventured into the deeper waters, which greatly increased the cost and difficulties of fishing. The deep-water beds which opened a new era of prosperity for the quahaug industry, are now beginning to show the effects of the severe

systematic fishery which has prevailed for the past few years. There can be but one logical outcome to the present system, *i.e.,* the commercial extinction of the quahaug.

The serious nature of this decline has only recently been brought to the attention of the public, although many have noticed the increased cost of shellfish and at times have experienced difficulty in procuring a sufficient supply. At present there is a widespread awakening throughout the Commonwealth in regard to the cost of living, and considerable interest has been shown in matters relating to the shellfisheries, with a view toward checking the decline by developing these important sources of public wealth.

The present quahaug industry is of comparatively recent growth. Although known as an article of food by the early settlers ever since the time of the Pilgrims, the quahaug did not attain universal popularity until within the last thirty years, when the opening of inland markets increased the demand. The resultant high prices naturally caused a large number of men to venture into the industry, stimulated by the hope of handsome profits. Soon there came a time when the natural increase of the fertile quahaug beds failed to equal the annual harvest, and a gradual decline set in, which has attained such magnitude as to threaten the extinction of a most important shore industry, assuming such serious proportions in many of our coast towns as to thoroughly alarm the citizens. In Buzzard's Bay, a natural habitat of the quahaug, the industry in at least half the towns has declined to the point of commercial extinction, and even in the communities where it still retains some foothold, its existence is due to the development of new areas in the deeper waters. Conditions in many localities on Cape Cod are scarcely better. Wellfleet, one of the leading towns of the Commonwealth in the production of quahaugs, presents a typical case of this kind. Practically the entire population, directly or indirectly, depends upon this industry for a livelihood. The quahaug fleet, comprising nearly a hundred boats of all sizes, which may be seen every fair summer day fishing in various parts of the bay, is fast depleting the large natural beds of this region, and already the inhabitants are becoming apprehensive of the exhaustion of these areas. Similar conditions prevail to a greater or less degree in most of the villages of Cape Cod, and serious complications would doubtless follow the destruction of the quahaug fishery.

Indications of Decline. — So universal has this decline become that it is hardly necessary to enumerate proofs of its existence. As already stated, the industry has been practically exterminated in many of the coast towns, while in others the natural supply is but a remnant of its former abundance, and there are but few localities where the yield of the natural beds has not decreased more or less. No one can question that the decline in the quahaug industry is general, and that its

proper adjustment, as one of the great resources of the Commonwealth, is an important economic problem.

Rise in Price. — When the demand for any commodity increases, it is a law of economics that a rise in price will follow. We have seen how the demand for quahaugs has increased during the past twenty years. It was inevitable that there should be a rise in price. The development of the "little neck" (small quahaug) trade was the forerunner of the introduction of the larger quahaug. The increase in the price, while in part the result of an increasing demand, is also a sign of a decreasing supply. When the supply of a desirable commodity diminishes, the price advances, until a new equilibrium is established. Therefore, both supply and demand have combined to place the price of the quahaug at its present high figure.

Cause of the Decline. — In considering the present unsatisfactory conditions in the quahaug industry no one cause can be designated as having brought about this decline, but rather it has been the result of the combination of several important factors. The primary reason has undoubtedly been overfishing, a fact generally accepted throughout the fishing communities of the State. So long as the natural increase of the quahaug equals the amount taken from the flats it is clearly evident that the supply will not diminish. As soon, however, as the demand of the market necessitates a constantly greater annual production, the balance of nature is upset, and a diminution of the natural supply takes place. As we have already seen, the simultaneous decrease in the supply and increase in the demand caused a rise in the price, sufficient for a time to lure more men into the industry. This time of prosperity has already passed, and many men are leaving the fishery to seek a livelihood in other pursuits, as, in spite of the high prices, they are unable any longer to make a living. The discovery of large quahaug beds in the deep water was the only factor that prevented the destruction of the quahaug fishery long ago. These beds are now being overfished, and when they are depleted the disappearance of this great industry will be complete.

While the immediate cause of the decline is undoubtedly, and always has been, overfishing, the real cause lies in the conditions which tolerated such a system of spoliation, and allowed it to continue unchecked after its destructive features had long been apparent.

Under the old laws governing the fisheries of the Commonwealth, the State originally held possession of and exercised authority over all tidal waters as public property for every citizen. Later there arose a widespread feeling that the communities whose lands bordered on the ocean should have first right over these valuable territories. This feeling on account of the conditions of that time, met with little opposition, as transportation was slow and the people from the inland communities had not the same opportunities for utilizing the fishing privileges that the inhabitants of the coast towns possessed. Thus

the rights of the Commonwealth over the shellfisheries came to be vested in the individual seacoast towns. According to the original act the selectmen of every coast town were given certain privileges of supervision over the shellfish interests within its borders. The Legislature, however, was careful to specify that every inhabitant of the Commonwealth could still continue to take shellfish for family use or three bushels for bait per day in any part of the coast, in this manner reserving an important privilege for the public.

As this privilege has never been exercised to any extent for market purposes, the towns have had absolute control of the shellfisheries for years. Their authority has been a direct trust from the Commonwealth, and if the decline of the shellfisheries has been attributable to improper legislation, or lack of legislation, this responsibility rests wholly upon the seacoast towns. Let us see in what manner these towns have improved the valuable privileges, and how they have guarded the sacred trust conferred upon them by the Commonwealth. The past record of the majority of the towns fails to show any consistent effort on their part to safeguard or develop these industries. A few communities have made certain short-lived attempts to foster or protect their native resources, but in every important instance these efforts have proved either wholly inadequate, or, if possessing the qualities of success, have been abandoned without sufficient trial. The usual type of reform attempted by the towns has been restrictive legislation, which has aimed in an illogical and ineffectual manner to check the exploitation of the natural beds rather than provide methods of increasing the supply. Legislation of this kind has never proved a success in any important instance. It has been unpopular, difficult to enforce and thoroughly unadapted to effect the intended reform. It is inherently a false or mistaken policy. The shellfisheries have needed laws of a constructive nature, designed to develop the industry. Restrictive legislation unless accompanied by constructive is never truly protective, and in the past has proved such an unqualified failure as to be abandoned by its former advocates. It is not the purpose of this paper to criticise harshly the evidently well-meant efforts of the towns to benefit the shellfisheries, but it is universally conceded that they have in most cases proved a failure. It is not necessary to go into detail in the investigation of the various attempts of the towns in this direction, as they have taken in almost all cases the form of a close season over some specified areas, and few attempts to build up the natural resources have ever been honestly attempted. In the case of the quahaug fishing, we find that the efforts of the towns to keep the supply from becoming depleted have never been more than the most half-hearted attempts, and we are forced to conclude that the towns have dealt badly with the trust reposed in them by the Commonwealth, and have neglected the great opportunities for improving and preserving the natural quahaug beds.

It is only fair to state that the system of town control is ill calculated to produce the best results. It is not reasonable to suppose that a number of municipalities, working independently, should be able to evolve a unified system. It is, however, just cause for surprise that the Commonwealth has so long allowed such mismanagement. It is certainly a most pressing need that this old, cumbersome policy should give place to a more unified and successful system.

Under the present system of free fishing no constructive legislation can be applied, as there is no incentive for individual effort. The fishermen who advocate cultural methods and conservation of the natural resources are powerless through the indifference of others, and consequently are forced, against their will, to join the campaign of spoliation under the argument that they may as well get their share as long as the supply lasts. In this way the present system puts a premium on personal greed and discourages individual effort. It is practically impossible for legislation to check lawless exploitation where valuable resources are thrown open to the public. The unreasoning element will inevitably abuse the privilege to the utmost limit, and the more thoughtful will be swept into tacit consent. Naturally it would be for the general welfare for every fisherman to do his best to better conditions, but under the present system this rule could not hold, as no man, no matter how much a philanthropist, will work hard for the betterment of conditions only to see the results of his work appropriated by another.

The Remedy.

We have pointed out that the attempts by which the towns endeavored to stop the decline of the quahaug supply were all of a restrictive nature, designed to check the demand rather than to increase the supply. The true remedy is to be found in legislation which will permit the application of cultural methods. There are only two methods by which constructive laws can operate: (1) seeding the public waters and flats at the expense of the towns or of the State; (2) the introduction of a system of private grants.

(1) While there has never been any effort on the part of the towns or of the State to seed extensive tracts of quahaug territory, there have been attempts in the case of the soft-shelled clam. Such communal clam culture has generally failed, as the planting was usually in the hands of men unaccustomed to such work and ignorant of the proper methods. While successful communal culture can be carried on, there will always remain the natural drawbacks to any altruistic scheme of this sort, such as expense, uncertainty and non-co-operation, which tend to make it impractical.

(2) The proposed remedy for preserving the native quahaug beds and developing the industry to its normal status is based upon a system of grants held and operated by individuals. Under this system an inhabitant of the Commonwealth would be permitted to lease a grant

of limited area from the State or town for a term of years, provisional upon the efficiency with which he improves his holding, and be guaranteed immunity from outside molestation. For this privilege he would pay a reasonable annual rental to the Commonwealth or town in addition to the taxes which would be levied by the town upon the value of his holdings. A system of this sort, which would allow a part of the waters in each town to become rented property, while the remainder, at least half the present area, should exist as public property, would so benefit the industry that the annual production for the rented part alone would doubtless exceed the present output for the whole under existing conditions. This proposed remedy has been the outgrowth of a long series of experiments on the part of the Massachusetts Department of Fisheries and Game. These experiments have aimed throughout to formulate a practical remedy for the prevailing evils. The experiments in question have shown conclusively that quahaug seed can be successfully transplanted from one locality to another, and that it can be made to grow to a marketable size with a small outlay of capital in a sufficient time to yield large returns. Not only have these experiments, conducted in varied environments in our coast waters, proved that this remedy contains the necessary elements of success, but a study of the industry as a whole has shown that it is the only remedy which can bring about the desired results. The proposed remedy is not a theory evolved on the spur of the moment, but is the outgrowth of several years of careful study of the prevailing conditions along our coast. It is a system based on the results of successful experiments, and has been placed on a practical, commercial basis with the oyster, both abroad and in the United States.

Benefits. — (1) It will save the declining industry by lessening the drain on the natural beds and by meeting the increasing demands of the market. Moreover, the "spawners" on the grants will in all probability suffice to abundantly seed all the public ground, at least to a greater degree than at present.

(2) It will increase the supply to more adequately meet the demands of the market. The quahaug has become a popular article of diet and there is no reason why it should not be a far more important item in the food supply of the Commonwealth than it is at present. In Massachusetts, where the population is so dense that it has to depend in great measure on other sections of the country for its supply of foodstuffs, any important article of food native to the Commonwealth should be well cared for.

(3) It would furnish more remunerative and steady work for the fishermen. This result would be accomplished in two ways: it would increase the supply of shellfish on the flats and tidal waters, held in common as already explained, thus increasing the catch of the average fisherman. But of greater value to the fisherman would be the privilege of holding a small piece of territory as his own property, which

should, under favorable circumstances, yield him a considerable annual income.

(4) It would be a benefit to the coast communities, where the shellfish industry furnishes the main income of the inhabitants. Under present conditions these communities depend for support on an uncertain industry, the revenue from which is extremely variable. Under these discouraging conditions many fishermen live literally from day to day, barely tiding over the severe winters with the money earned during the summer's fishing. The proposed system would do away in a great measure with this unsatisfactory state of affairs, as it would practically assure to every industrious quahauger a steady income.

(5) It would furnish a more abundant sea food for the public. Any undertaking which will result in increasing the supply is desirable from an economic standpoint. The quahaug as an article of diet has had a favorable reputation for some years. Its popularity is steadily growing, and anything which would tend to increase the supply must be considered a public benefit.

(6) It would utilize thousands of acres of barren land now lying idle and unproductive. It has been a wise policy of this country for many years, fostered by men who have the national interests at heart, to conserve the natural resources and bring them to their highest degree of usefulness. In Massachusetts, not primarily an agricultural State, large tracts of territory, which in the fertile western countries would never be touched, are nevertheless, by careful tillage, made to yield profitable returns. It seems poorly in accord with the prevailing methods of thrift that large areas along our shore, which are more valuable acre for acre than any upland, should be allowed to remain unproductive, when they could, with a comparatively slight expenditure of time and money, be made to yield substantial returns. It is inconceivable that such a misguided policy can much longer control the shellfisheries. Already the matter has attracted popular attention, and will soon be dealt with in the same progressive spirit which Massachusetts has ever shown in the management of her industries.

Quahaug Farming.

Under the proposed system of quahaug culture the available territory comprising the tidal flats and shallow waters of our coasts would be dotted with small areas under artificial cultivation. There would be a striking similarity in this arrangement to a tract of agricultural country where fertile gardens are interspersed with stretches of meadow and pasture land. There can be no question that the system which holds sway over the agricultural districts of our country is equally desirable for our extensive shore areas, which now produce but a portion of their normal yield. If these tracts could be divided, in part at least, into small plots of cultivated ground, nature would be greatly assisted in her efforts to render these territories productive.

That we may see to what degree the installation of such a system would affect the industry, let us take one of these proposed cultivated plots or grants to serve as a model. The average fisherman, an industrious family man, would take out one of these little grants. At first he would not depend very much on the income derived in this manner, but would probably continue to fish on the public grounds. Gradually, as he became accustomed to its management, he would come to look more and more to his own leased territory for a livelihood. He would be constantly on the outlook in his trips around the bays and coves of his home district for little "pocket" beds of small quahaugs, where he could procure seed for his grant. He would carry this seed carefully home with him, and experiment, with ever-increasing interest, in planting so as to insure the least loss and greatest gain. He would be ever anxious to see how his novel harvest was maturing, looking over his bed from time to time to note the growth of the seed, and to remove cockles and other enemies. If his little farm were located between tide lines he would be careful to have his seed planted early in the spring, and would in most cases harvest the entire crop late in the fall or early winter, before it suffered exposure to the ice. If his grant were situated just below mean low-water mark, where it would never be exposed, he could probably allow his seed to remain for two seasons, when it would yield a still better profit. But wherever situated, on soil at all suitable, he would possess in his little holding of an acre or more property of such value that he would be able, under normal conditions, to reap enough to support his family in very comfortable circumstances. He would be able to do this with far less expense of time and labor than enterprises of this sort usually require. While his grant would in every material respect be a miniature farm, and would probably be known as such, it would be entirely free from most of the labor involved in the care of the ordinary farm. No time would have to be devoted to the work of plowing, harrowing or weeding, which makes the life of the average farmer such a hard-working existence. There would be none of the expense and labor of fertilizing, so necessary for the success of upland gardening; there would be little or no time required in fighting the natural enemies of the growing crop which the upland farmer experiences. The quahaug has few enemies, and these do little damage, and are, besides, easy to fight. The fisherman-farmer would be free from anxiety on account of the weather, over which his more unfortunate neighbor of the upland so constantly worries. No drought, beating rain or early frost is likely to injure his growing crop. Practically the only labor required is that of seeding and harvesting, which are simpler and easier for the shellfish culturist than for the farmer. The ordinary farmer is frequently content to reap from his average acre of cultivated ground from $20 to $50. The quahaug planter on an equal territory could raise

many times that amount as under favorable circumstances $750 net may be realized annually from one acre.

The comparison is strikingly in favor of the quahaug grant, and the benefit of such a system is sure to follow for all coast communities. The shellfisherman is raised from an uncertain livelihood to a position of secure and comfortable independence, the communities made more prosperous and a decadent industry revived.

History of Quahaug Farming. — Until within recent years few attempts at quahaug culture have been made in Massachusetts, although for some time oystermen in the States directly south have carried on successful planting. The demand for small seed has extended even to Massachusetts, and many thousand bushels have been shipped out of the State for planting purposes. Nantucket, Chatham, and finally New Bedford have taken their turn in this traffic, according to the abundance of small quahaugs. In 1909 one New York planter is authentically reported to have purchased nearly 5,000 bushels of seed from Massachusetts, paying $3 per bushel. During 1909 the shipment of seed from New Bedford and Fairhaven approximated 45,000 bushels. These small quahaugs are replanted in Long Island waters, and in one year's time, according to the results of growth experiments, probably netted the planter at least 4 bushels of marketable little necks for every bushel planted. Lately some of the Massachusetts oystermen have successfully raised quahaugs on their oyster grants, and are ready to engage in a more extensive way.

The first legislative act permitting the planting of quahaugs was passed for the Narragansett Bay section in 1874. This legislation permitted the giving of licenses for the planting of shellfish in the town bordering on Mount Hope Bay. Nothing was accomplished, however, as the law was repealed the following year. The second movement took the form of a special law permitting the bedding of quahaugs in Eastham, Orleans and Wellfleet in 1904, which in fact was a semi-license. Finally, in 1909 a general law was passed, which gave local option to the coast towns in the giving of grants. As yet these laws appear to be without result. The "bedding" act was utilized to some extent to hold quahaugs for market, and in a few cases for growing purposes. No town has as yet taken advantage of the general law. What culture has been carried on has been done secretly or on the oyster grants, where protection is given. Under these adverse conditions planting has proved remunerative, and there is every indication that, when absolute protection is guaranteed the culturist, a flourishing industry will be inaugurated.

Possibilities of Quahaug Farming. — While the subject of clam farming has received a great deal of attention, people have failed to see that the same cultural methods can be employed even to greater advantage with the quahaug. A quahaug farm, if properly tended,

should yield more revenue, acre for acre, than any clam flat, and prove a much safer investment for the planter. If it were not for the scarcity of seed at the present time, quahaug culture, although confined to the southern waters of the Commonwealth, would become the greatest of the shellfish industries of Massachusetts.

The quahaug has a wide range; it is found in all depths of water, from the high-tide line to a depth of more than 50 feet, and in various kinds of bottom. This natural adaptability gives the quahaug a wider area than any other commercial shellfish, as it will live in almost any soil, although the rate of growth depends essentially upon its location in respect to current. Vast areas, over 25,000 acres, on the southern shores of Massachusetts, at present unproductive except for here and there small scattering beds, can be utilized for shellfish farms, which, when placed under cultural methods, should yield many times the present production and furnish a livelihood for thousands of men. Quahaugs will grow on such areas as the Common Flats of Chatham, if they are planted and properly cared for. Instance after instance can be cited where the territory is so extensive that if every inhabitant of that particular locality were allotted a grant of two or three acres, the leased portion would be but a small part of the whole area. It is conservation of our natural resources in the truest sense to make use of the great undeveloped possibilities of our shore waters.

Methods of operating a Quahaug Farm.

Selecting the Ground. — The planter should have two main ideas in mind in choosing the location of his grant: (1) facilities for work and marketing; (2) productive capacity. The ideal grant combines the two, where the work is easy and the growth rapid, while a near-by market furnishes high prices. Unfortunately, such delightful combinations are few, and the culturist will have to choose a grant with such qualifications as he thinks best suited to his needs. For this reason it is desirable to consider these points more in detail.

(1) Facilities for work comprise three things: (*a*) The accessibility of the grant to the home of the culturist, where he can get to it without loss of time and where he can have a protective oversight. The term " home " is used here in the sense of landing place, boat mooring or shellfish shanty, where the culturist keeps his equipment. (*b*) The depth of water over the bed, and the nature of the bottom, as raking in shallow water is much easier and less expensive as to time and implements than the deep-water quahauging, while the firmness of the bottom increases the work of raking. If, perchance, the grant is between the tide lines the labor of harvesting the quahaugs is less than if they were continually covered by water, but in such a case the working period is limited, and the quahaug culturist risks the destruction of his crop during the winter. (*c*) The ease of marketing is another

factor, as distance and poor transportation facilities add to the expense. The planter must consider the question of bringing his produce as cheaply as possible to the railroad.

(2) The most important factor in the selection of the ground is its productive capacity. The prime requisite of a grant is a rapid rate of growth, which, for a grant situated below mean low-water mark, depends upon two conditions, — the current or circulation of water and the nature of the soil. In the case of the few grants existing either permanently or temporarily between the tide lines, a third condition, exposure, demands attention, as the time of exposure at low tide reduces the feeding period of the quahaug. As the majority of the grants will be below low-water mark the other two conditions are more important.

(*a*) *Soil.* — The nature of the soil affects the quahaug in two ways: (1) if too shifting it buries the quahaug or washes it beyond the border of the grant; (2) soils in which organic acids, caused by the decay of plant life, are present, prove unsatisfactory for any catching of seed, interfere to a slight extent with the growth by destroying the shell, and worst of all, give the quahaug a poor, black appearance, unfavorable for immediate marketing. While the effect of soils on shell formation has never been worked out, and although the quahaug derives its material for its shell from the water, nevertheless, the nature of the soil in some indirect way determines the appearance, the composition and the weight of the shell, as observations on quahaugs from various soils in near-by localities indicate.

(*b*) *Current.* — The growth of the quahaug depends upon the circulation of water, as the current is the "food carrier," and therefore, within limits, the more current, the more food. Current also keeps the ground clean, and prevents contamination or disease from spreading. The most important point in choosing the ground is to locate the grant where there is a good current, as growth is directly proportional to the circulation of the water. It is possible, of course, for a place to have so rapid a current that it would cause a shifting of the bottom, and perhaps wash the quahaugs from their burrows, but such a current is found in but few localities in which one would think of planting.

There are several other factors which do not influence the growth directly but at the same time have more or less influence upon the productive qualities of the grant.

(*c*) *Pollution.* — It is hardly necessary to more than mention the danger to public health and the depreciation in the value of the marketed quahaugs when it is publicly known that the grant is situated in contaminated waters. For purely business reasons the planter should ascertain the purity of the water in the locality of his proposed grant, as in the future the public will demand the closure of all polluted waters and discountenance the sale of shellfish from such sources.

(*d*) The proximity of localities where seed quahaugs may be readily

obtained should be considered, as the cost of obtaining the necessary stock is an important item. If the grant can be situated in the vicinity of a natural quahaug bar, where seed can be obtained from the natural set, it will prove advantageous. If a method of artificial hatching of the seed, either from the egg or by spat collecting, is successfully placed on a commercial basis, such a precaution will not be necessary, as the quahaug culturist, like the oysterman, will be able to raise his own seed.

(*e*) Closely connected with the study of the food of the quahaug comes the question of flavor of the meat, an important item in marketing. It is a well-known fact that quahaugs from various localities have different flavors, and in the future there will be a greater use of trade names and special brands, based on this fact. The flavor of a quahaug depends upon its environment, and, although it has not been absolutely proved, evidence points to the fact that the different flavors are due to the different kinds of plant food. In the future, when more practical knowledge is obtained about the food of these animals, it may be possible to supply special flavors by artificial cultures of food. Another factor determining the condition of the meats is the presence of oils, chemicals, etc., from factory wastes, which sometimes renders the shellfish unsavory. The soil and the silt in the water may also influence the flavor.

(*f*) The grant should be chosen in a well-protected locality. Natural conditions, such as loose sand, exposure to winds and choppy seas, increase both the loss of stock and difficulty of labor. Masses of floating eelgrass in some places are strewn over the bottom by storms. interfering with the growth and increasing the labor. Fortunately, the quahaug is hardy, and is not affected to any great extent by the elements, except when the grant is located between the tide lines. A grant between the tide lines or close to low-water mark is an uncertain investment, as there is always danger of destruction during a severe winter, either by the ice or frost. The danger is not so much in the freezing of the quahaug as it is in the sudden thawing. If frozen quahaugs are slowly thawed out they will assume normal functions, as if nothing had happened, but when thawed out quickly many perish. From observation it can be said that in a fairly protected locality, where the grant is not too high between the tide lines, the chances of loss from winter will not be more than one case out of seven.

In some localities there may occur a slight loss from the winkle, a natural enemy of the quahaug. The culturist can, by more or less labor, according to their abundance, keep them off his property. As the winkle is valuable for bait, the actual loss of time will be minimized, and even if unmolested the damage will be slight.

The rule for choosing a grant should be: bottom of a mixture of mud and sand (exact nature of soil not important); clear of eelgrass,

especially thick eelgrass; water the depth of 3 feet or more at low tide; a *good current;* and such facilities for work as best suits the particular planter.

Obtaining the Seed. — Nature has not provided so abundant a means of stocking the quahaug farms as is the case with the clam. The set of quahaugs is more scattering and apparently less abundant. In nature this is not necessary, because the young quahaugs after once they have taken refuge in the sand, are more hardy than the young clams, which perish in great numbers. Occasionally natural sets will be found in limited localities, as Stony Bar, Wellfleet; Mill Pond, Chatham; Acushnet River, etc. From these places the seed must be obtained. At the present writing Acushnet River and Tuckernuck Island have large beds of seed, which the inhabitants are industriously shipping to planters outside the Commonwealth. As these beds vary, occurring in different sections in succeeding years, the natural seed must be purchased from the specially favored localities. Small quahaugs can also be obtained from Prince Edward Island, and probably from the southern States.

The planters might experiment in catching seed by simulating the natural conditions of the seed bars on their grants, and turn their grounds into spat collectors. By the combined efforts of interested planters it would not be many years before a practical method of spat collecting could be devised. As the object of most planters would be the production of "little necks," the size for planting would be under the maximum market "little neck."

Planting. — The grant needs little preparation for planting. After the bounds are marked according to the regulations, thick eelgrass, stones and other débris which would interfere with the raking, and enemies such as winkles, should be gradually removed, either before planting or in the work of harvesting. The planting of the small quahaugs is a simple matter. It should take place preferably before May 1, when the quahaug begins its summer growth, but as seed is scarce, the planter will probably plant whenever he can procure the young. The quahaugs should be scattered evenly from a boat by shovels such as the oyster planters use, or it can be done in any way most convenient for the culturist. Ordinarily the quahaugs will burrow in the sand in a short time after they settle to the bottom. As their activity depends to a great extent on the temperature of the water, it is not advisable to plant in cold weather, as the quahaugs, instead of burrowing, will lie exposed on the surface, where they are in danger of perishing. The amount of seed that can be planted on any given area depends upon the natural conditions, chiefly the current. As many as 20 to the square foot can be bedded when the circulation is good, while the number should be decreased or increased according to the speed of the current. The planter, after a year or two, will be able to determine the exact number he can plant on his grant to the best advantage.

Working the Grant. — The work of caring for the grant will entail but slight labor. No cultivation of the ground is required, as in the upland farm, and the quahaug is left undisturbed until it has attained marketable size. A certain amount of oversight will be necessary to keep off poachers, and time must be given to destroy enemies and clean away any dead seaweed that drifts upon the grant, but further precautions are unnecessary.

Harvesting. — The principal labor comes in the harvesting of the crop, which must be done by raking or tonging. The location and natural conditions of the grant make this a variable factor, as depth of water, hardness of bottom and exposure to rough weather increase the difficulty of raking. While a certain portion of the crop may be taken at any season, the greater part will be marketed in the fall, when the season of raking on the natural beds is nearing a close, in order to get the advantage of the full summer's growth and the better winter prices. The fall work will apply only to the more protected grants which permit work in rough weather. The planter will have his grant divided into sections according to the size of the planted seed, which will be assigned in lots according to size and length of time before marketing. By dividing the ground into three or more parts, planted with quahaugs of different sizes, the culturist will have a sort of rotation of crops, cleaning up and replanting one-third of his property each year. In this way the planter will be able to place a uniform size on the market and receive a proportionately better price for his goods. There will be less labor in culling, and the "little necks" can be shipped directly in barrels or bags to special customers.

The Value of a Quahaug Farm. — An acre of "little-neck" quahaugs has a high market value. A conservative estimate of 10 per square foot gives an annual yield of 600 bushels of 2½-inch quahaugs per acre. This assumes that 120 bushels of 1¾-inch quahaugs were planted to the acre. The price paid for the same, at the high price of $5 per bushel, would be $600. The price received for the same, at $3 per bushel, would be $1,800, or a return of $3 for every $1 invested. This is a conservative estimate on all sides. Quahaugs could be planted two or three times as thick, seed might be purchased for less money, more money might be received for private shipments, and faster growth can be obtained. Practically the only labor necessary is gathering the quahaugs for market. The quahaug farm requires no such care as the agricultural farm, and offers far more profit.

Perhaps the greatest advantage to the fisherman, next to the amount of quahaugs he can produce from his grant, is the fact that he is independent of the market. The value of the present quahaug industry lies chiefly in the production of "little necks," which could be made a specialty under a cultural system. The planter can market his quahaugs at whatever size and whatever time he desires, and is not forced to ship during periods of low prices, as he can leave his quahaugs

bedded on his grant. At the present time the quahaugers, except in a few towns where there are "bedding rights," are forced to ship their catch as soon as taken, and receive often a low market price. In this way the planters could regulate, to a great extent, the market price for their own benefit.

Advantage of a Uniform Size. — At the present time there is much dissatisfaction among the quahaug fishermen who rake on the natural beds because they receive poor prices. From the fisherman's standpoint the dealer is to blame, as it is claimed that he is continually trying to increase the middleman's profits. From the point of view of the shellfish dealer the fault seems to be with the fisherman, who does not carefully select his stock for market. A dealer is bound to pay better prices for uniform and selected stock. The common practice is to ship as "little necks" quahaugs of all sizes from 1¼ to 3 inches, large and small promiscuously scattered through the barrel, or first a barrel of large, then small, with the result that in most cases the dealer knows not what to expect, and naturally gives a minimum price. Perhaps with more care on the part of the quahauger this circumstance might be improved to some extent; but the fault lies rather in the present method of fishing. The logical method of increasing the price is the steady shipment of uniform selected stock. This is entirely impossible under free-for-all fishing. Steady orders cannot be filled when raking is irregular; a uniform size cannot be shipped, owing to the varied yield of the natural beds; and the quahaugs, unless bedded as in Orleans, Wellfleet and Eastham, must be shipped for whatever price is offered. Quahaug culture with its grant system offers a remedy, and furnishes to the quahauger a means of controlling the market. In contrast to the free fishery, the yield from the quahaug farm is steady instead of irregular; only quahaugs of the maximum market size, necessarily uniform, need be shipped, and the best prices obtained for them, while the quahauger is not forced to ship at a low price, but can wait until the market reaches his figure. As an illustration of the difference in price between ordinary shipped "little necks" from the natural fishery and uniformly selected stock from leased area, the following case is cited: from a locality on Cape Cod in 1909 quahaugs were shipped to market, the selected stock bringing $18 a barrel to the planter at any season, the ordinary stock, ranging from 1½ to 3 inches, only $10. No other proof is needed to show the advantage of a uniformly selected stock, such as can be obtained only by quahaug farming.

THE INDUSTRY.

From the standpoint of the fisherman the methods of capture and preparation of the quahaug for the market need no explanation; but the average reader, perhaps unfamiliar with the practical side, may find the following pages of interest. In order to give a complete

report upon the quahaug fishery, owing to the fact that such data may be of use in later years for comparative purposes, it has been necessary to include special parts of the mollusk report of 1909.

The Fishing Grounds.

The quahaug is essentially a southern or warm-water mollusk and Massachusetts practically marks the northern range of the fishery, although quahaugs are taken in the Gulf of St. Lawrence. As shown on the accompanying map (Fig. 30), only the southern waters of the Commonwealth are included in this fishery. For greater detail the reader is referred to the "Mollusk Report" of 1909.

The quahaug like the scallop territory can be arbitrarily separated into four main divisions: (1) the north side of Cape Cod; (2) the south side of Cape Cod; (3) Buzzard's Bay; (4) the Islands of Nantucket and Martha's Vineyard.

North Side of Cape Cod. — In this section Plymouth marks the northern range, as a few quahaugs are found in this harbor. Passing south, small beds are found in Barnstable harbor, while from Brewster north, in the waters of Orleans, Eastham and Wellfleet, the largest quahaug fishery of the Commonwealth is carried on. A few quahaugs are also found in Provincetown harbor and along the Truro shore. The chief characteristics of this section are: the great rise and fall of the tide, averaging about 10 feet, which leaves large areas of exposed flats; the swiftness of the tides, causing a shifting of the sand bars; and the great depth of the water over the quahaug beds.

Quahaugs are found both on the flats and in all depths of water, although the commercial fishery is carried on mostly in the deep water, with rakes ranging from 30 to 60 feet in length. The best beds are in the deep water, as the other localities have been fished out, the quahauging gradually extending to the deeper or the more exposed waters. Unfortunately, quahaugs can be taken only on moderate days, as rough water interferes with raking, and the quahauger who can average four working days a week is considered fortunate. In this section the basket rake shown in Fig. 59 is used. Quahaugs are taken also with ordinary clam or garden rakes on the flats at low water, especially in the harbors during the low course tides. About 8,000 acres are included in this section.

(*a*) *Barnstable Harbor.* — In Barnstable harbor, on the north side of the town, a few quahaugs are found in isolated patches, which are of small commercial importance. In the future the vast barren flats may be made productive of quahaugs as well as clams, although at present the total area of the quahauging grounds is hardly 5 acres.

(*b*) *Orleans and Brewster.* — The fishery is conducted in the deep water, with the basket rake. The area comprises about 1,000 acres in Cape Cod Bay, and about 500 in Pleasant Bay, on the east side of the two towns.

(*c*) *Eastham.* — The quahaug territory comprises about 4,000 acres, extending from the shore for a distance of nearly 3 miles. While scattering quahaugs, largely blunts, are found over the entire area, the fishery is conducted only at certain places. In 1910 a thickly set bed of quahaugs was discovered south of Billingsgate Island. The question of town jurisdiction over this bed has caused the towns of Wellfleet and Eastham much legal dispute, court expense and hard feeling — another instance of the inefficiency of the present method of town shellfish regulation.

(*d*) *Wellfleet.* — The quahaug territory of Wellfleet comprises about 2,500 acres, and approximately takes up all the harbor, wherever there are no oyster grants, running from the "Deep Hole," between Great Island and Indian Neck, southward to the Eastham line. Outside these limits a few quahaugs are found on the flats of Duck Creek and along the shore. They are more abundant on the north side of Egg Island, where they are taken in shallow water with ordinary hand rakes. The best quahauging is found in the channel, extending from an imaginary line between Lieutenant's Island and Great Beach Hill south to Billingsgate and beyond. Here the greatest depth at low tide is 4½ fathoms, with a general average of 3 fathoms. Raking is done with long-handled basket rakes.

(*e*) *Provincetown.* — No commercial fishery is carried on. A few quahaugs, chiefly little necks, are found in the tide pools among the thatch on the northwestern side of the harbor.

South Side of Cape Cod. — This section, comprising the towns on the south side of Cape Cod from Chatham to Falmouth, ranging in order, from east to west, Chatham, Harwich, Dennis, Yarmouth, Barnstable, Mashpee and Falmouth, has less territory, about 5,000 acres, and produces only one-fifth of the yield on the north side of the Cape. While this section is favorable for the scallop, quahaugs are not found in any great numbers on the exposed waters on the Sound side, and the grounds are mostly confined, except in the case of the Common Flats of Chatham, to the enclosed bays and harbors, such as Pleasant Bay, Lewis Bay, Osterville Bay, Waquoit Bay, etc. Natural conditions are somewhat different than on the north side, as the rise and fall of the tide is slight, about 2 feet, and, owing to the sheltered conditions, raking can be carried on at all times during the summer months. The shallow water permits easier raking and the use of shorter handled rakes. Basket, claw and garden rakes are used, although the greater part of the commercial fishery is conducted with the basket type.

(*a*) *Chatham.* — Chatham is favorably situated in regard to the quahaug fishery, as this shellfish is found in the waters on the north and south sides of the town. The grounds are extensive, covering about 2,000 acres, the greater part of which consists of the vast area south of the town, known as the Common Flats. The quahauging grounds are in four localities: (1) Pleasant Bay; (2) Mill Pond; (3) Stage harbor; (4) Common Flats.

(*b*) *Harwich.* — Harwich shares with Chatham and Orleans the quahaug fishery of Pleasant Bay, but has a more limited territory, as only a small portion of Pleasant Bay lies within the town limits. Practically all this territory, comprising 100 acres, is quahauging ground, though the commercial quahauging is prosecuted over an area of 10 acres only. Scattering quahaugs are found over an area of 100 acres. In the southern waters of the town, on the Sound side, scattering quahaugs are found in certain localities, but are not of any commercial importance. The most important of those localities are off Dean's Creek and in Herring River, where quahaugs are dug for home consumption.

(*c*) *Dennis and Yarmouth.* — The quahauging grounds, about 200 acres in area, are practically all in Bass River, where Dennis and Yarmouth have equal fishery rights.

(*d*) *Barnstable.* — The greater part of the quahaug industry is conducted on the south shore of the town, which is especially adapted, with its numerous inlets, for the growth of this shellfish. The principal fishery is in Cotuit harbor and West Bay, and is chiefly shared by the villages of Osterville, Marston's Mills and Cotuit, which lie on the east, north and west sides, respectively, of the bay. The principal area for quahauging is a flat along Oyster Island, comprising about 70 acres of sandy bottom, while directly west, in the center of the harbor, is a strip of 80 acres of mud and eelgrass where scallops and quahaugs abound. Scattering quahaugs are found in Osterville harbor, West Bay, Poponesset River and East Bay, comprising a total of 1,650 acres, of which part only is productive. At Hyannis the grounds are confined to Lewis Bay, where they cover an area of 800 acres. Quahaugs are found in scattered patches over this area, but in no place is quahauging especially good.

(*e*) *Mashpee.* — The best grounds are found in Peponesset Bay and river, where a territory of 200 acres includes several oyster grants, which are worked but little. On the east side of Waquoit Bay scattering quahaugs are found in Mashpee waters.

(*f*) *Falmouth.* — There is practically no quahaug industry in Falmouth. Hardly 100 bushels are dug annually, and those only for home consumption. A few quahaugs are perhaps shipped by the oystermen. Quahaugs are found mostly in scattering quantities over a large area in Waquoit Bay, and in small quantities on the north and west side of Great Pond, comprising a total of nearly 400 acres. Not all this ground is capable of producing quahaugs, but many parts could produce good harvests.

Buzzard's Bay. — The Buzzard's Bay section comprises the towns bordering on the bay, and includes the towns of Falmouth, Bourne, Wareham, Marion, Mattapoisett, Fairhaven and New Bedford, covering an area of about 8,000 acres of quahauging territory. This section is naturally well adapted for the quahaug, as conditions are especially

favorable for its habitation. The numerous inlets and bays, the medium rise and fall of the tide, the influx of the water as it courses in and out of the little bays and estuaries, together with its warmth and the abundance of food forms, renders Buzzard's Bay extremely well situated for the growth and propagation of the quahaug. This section shows the greatest effects of overfishing, as part of the beds have been almost exhausted and the remainder are under a severe strain. The quahaug can never be exterminated completely, as when the supply becomes scarce the number of men engaged in the fishery diminish, but it is comparatively easy to ruin the commercial industry. The natural adaptability of Buzzard's Bay will never fully be utilized until a system of quahaug planting is inaugurated, whereby nature will be assisted in the restocking of the depleted areas. Fishing is carried on with a variety of rakes, from an ordinary garden to the large basket rake.

(*a*) *Falmouth.* — Small patches of good quahaugs are found at North Falmouth, Squeteague Pond, West Falmouth harbor on the southeast side, and a few in Hadley harbor, Naushon.

(*b*) *Bourne.* — Situated at the head of Buzzard's Bay, and separated from the adjacent town of Wareham by Cohasset Narrows, Bourne has many advantages for a profitable quahaug industry. It possesses nearly twice as much quahaug territory as Wareham, but, as most of this is unproductive, has a smaller annual output. The territory includes over 2,500 acres of ground, most of which consists of flats of mud, sand and eelgrass, covered with shallow water. It is very sparsely set with quahaugs. Outside the oyster grants practically the entire stretch of coast from Buttermilk Bay to Wing's Neck is quahauging territory. Other grounds lie between Basset's Island, Scraggy Neck and Handy's Point.

(*c*) *Wareham.* — Quahaugs are found over practically the entire territory, and comprise a total area of about 1,300 acres. Although much of this area is barren, the commercial fishery is maintained by small isolated beds which occur here and there. The two principal centers of the industry are in Wareham River and Onset Bay. At Onset the whole bay, except the oyster grants, as included between the southeast end of Mashnee Island and Peter's Neck, is used for quahauging. A few quahaugs are found in Broad Cove, and fair digging is obtained in Buttermilk Bay and Cohasset Narrows. The Wareham River, outside the oyster grants, and a narrow shore strip from Weweantit River to Tempe's Knob, comprise the rest of the territory. In Onset channel a fine bed exists in deep water, 2 to 4 fathoms, but the ground is so hard that not much digging is done.

(*d*) *Marion.* — The quahaug territory, comprising a total of 400 acres, is chiefly confined to Marion harbor, running in a narrow strip parallel to the shore from Aucoot Cove all along the coast to Planting Island. Almost all the head of the harbor and all of Blankenship's

and Planting Island Cove is quahaug area. Small grounds are also found at Wing's Cove and in the Weweantit River.

(*e*) *Mattapoisett.* — Quahaugs are very unevenly distributed over 800 acres. The best quahaugs are found in Aucoot Cave and at Brants. In the main harbor scattering quahaugs are found.

(*f*) *Fairhaven.* — Some 3,000 acres are more or less bedded with quahaugs. Of this, probably not more than one-tenth is very productive. The best quahauging is in Acushnet River, where digging for market has been forbidden because of sewage pollution (see New Bedford), and in Priest's Cove as far as Sconticut Neck. In these grounds "little necks" are numerous. The grounds around West Island and Long Island, once very productive, are now largely dug out. Little Bay and the east coast of Sconticut Neck are fairly productive, while the west coast yields only a small amount. Most of the quahaugs dug for food come from the deep water west-southwest of Sconticut Neck.

(*g*) *New Bedford.* — Good beds of quahaugs, particularly "little necks," exist in Acushnet River and Clark's Cove, but can be taken only for bait. As several sewers run into the Acushnet River, and the public health was endangered by the consumption as food of the quahaugs taken from the river and the waters near its mouth, nearly 400 acres of quahaug territory were closed by the State Board of Health. What little available territory there is outside the proscribed area, off Clark's Point, is free to all.

The Islands of Nantucket and Martha's Vineyard. — This section comprises valuable territory, especially in the production of "little necks." The grounds, approximating 7,000 acres, are found principally in Katama Bay, Edgartown, Nantucket harbor and near the Island of Tuckernuck. Conditions here resemble closely the south side of Cape Cod, as regards exposure, rise and fall of the tide, and depth of water.

(*a*) *Nantucket.* — Nantucket is especially adapted for quahaugs, as Nantucket harbor, Maddequet harbor and the Island of Tuckernuck possess extensive territory. The quahauging territory of Nantucket is divided into three sections: (1) Nantucket harbor; (2) Maddequet harbor; and (3) Tuckernuck. In Nantucket harbor quahaugs are found over an area of 2,290 acres, both scattering and in thick patches. Maddequet harbor, on the western end of the island, has approximately 300 acres suitable for quahaugs, running from Broad Creek to Eel Point. On the eastern end of Tuckernuck Island is a bed of quahaugs covering about 200 acres; while on the west side, between Muskeget and Tuckernuck, is a large area of 2,500 acres which is more or less productive. The Tuckernuck fishery is largely "little necks," and it is from here that the shipment of small seed quahaugs has been made.

(*b*) *Edgartown.* — The finest "little neck" fishery in Massachusetts is found in Katama Bay, in the town of Edgartown. Two-fifths of the entire catch are "little necks." The most productive grounds are

situated in the lower part of Katama Bay, while quahaugs are also found in Edgartown harbor and in Cape Poge Pond, the total area of these localities comprising 1,800 acres.

Industrial Practices.

Methods of Capture. — Several methods of taking quahaugs are in vogue in Massachusetts, some simple and primitive, others more advanced and complex, but all modifications of simple raking or digging. These methods have arisen with the development of the industry, and record the historical changes in the quahaug fishery, as each new fishery or separate locality demands some modification of the usual methods.

(*a*) *"Treading."* — The early settlers in Massachusetts quickly learned from the Indians the primitive method of "treading" quahaugs, which required no implements except the hands and feet. The "treader" catches the quahaug by wading about in the water, feeling for them with his toes in the soft mud, and then picking them up by hand. Nowhere in Massachusetts is it used as a method of commercial fishery.

(*b*) *Tidal Flat Fishery.* — Often quahaugs are found on the exposed tidal flats, where they can sometimes be taken by hand, but more often with ordinary clam hoes or short rakes. Owing to the scarcity of quahaugs between the tide lines, this method does not pay for market fishing, and is resorted to only by people who dig for home consumption.

(*c*) *Tonging.* — In most parts of Buzzard's Bay and in a few places on Cape Cod quahaugs are taken with *oyster tongs.* This method is applicable only in water less than 12 feet deep, as the longest tongs measure but 16 feet. Four sizes of tongs are used, 8, 10, 12 and 16 feet in length. Tonging is carried on in the small coves and inlets, where there is little if any rough water. A muddy bottom is usually preferable, as a firm, hard soil increases the labor of manipulating the tongs, which are used in the same manner as in tonging oysters.

(*d*) *Raking.* — The most universal way of taking quahaugs is with rakes. This method is used in every quahaug locality in Massachusetts, each town having its special kind of rake. Four main types of rakes can be recognized: —

(1) *The Digger.* — In some localities, chiefly in Buzzard's Bay, the ordinary potato digger or rake, having four or five long, thin prongs, is used. Usually it has a back of wire netting, which holds the quahaugs when caught by the prongs. As the digger has a short handle of 5 feet, it can be used only in shallow water, where the quahauger, wading in the water, turns out the quahaugs with this narrow rake. This method yields but a scanty return, and is more often used for home consumption than for market.

(2) *The Garden Rake.* — The ordinary garden rake, equipped with a basket back of wire netting, is in more general use in shallow water, either by wading or from a boat, as it has the advantage of being wider than the potato digger.

(3) *The Claw Rake.* — This type of rake varies in size, width and length of handle. It is used chiefly at Nantucket. The usual style has a handle 6 feet long, while the iron part in the form of a claw or talon is 10 inches wide, with prongs 1 inch apart. Heavier rakes with longer handles are

sometimes used for deep water, but for shallow water the usual form is the short-claw rake.

(4) *The Basket Rake.* — The greater part of the quahaug production is taken from deep water, with the basket rake. These rakes have handles running from 23 to 65 feet in length, according to the depth of water over the beds. Where the water is of various depths, several detachable handles of various lengths are used. At the end of these long handles is a small cross-piece, similar to the cross-piece of a lawn mower; this enables the quahauger to obtain a strong pull when raking. The handles are made of strong wood, and are very thin and flexible, not exceeding 1½ inches in diameter. The price of these handles varies according to the length, but the average price is about $2. As the long handles break very easily, great care must be taken in raking.

Three forms of the basket rake are used in Massachusetts. These rakes vary greatly in form and size, and it is merely a question of opinion which variety is the best, as all are made on the same general principle, — a curved, basket-shaped body, the bottom edge of which is set with thin steel teeth.

The Wellfleet and Chatham rake is perhaps the most generally used for all deep-water quahauging on Cape Cod, and finds favor with all. It consists of an iron framework, forming a curved bowl, the under edge of which is set with thin steel teeth varying in length from 2 to 4 inches, though usually 2½-inch teeth are the favorite. Formerly these teeth were made of iron, but owing to the rapid wear it was found necessary to make them of steel. Over the bowl of this rake, which is strengthened by side and cross pieces of iron, is fitted a twine net, which, like the net of a scallop dredge, drags behind the framework. An average rake has from 19 to 21 teeth, and weighs from 15 to 20 pounds.

The basket rake used at Edgartown and Nantucket is lighter and somewhat smaller than the Wellfleet rake. The whole rake, except the teeth, is made of iron. No netting is required, as thin iron wires ⅓ inch apart encircle lengthwise the whole basket, preventing the escape of any marketable quahaug, and at the same time allowing the mud to wash out. This rake has 16 steel teeth, 1½ inches long, fitted at intervals of 1 inch in the bottom scraping bar, which is 16 inches long; the depth of the basket is about 8 inches. Shorter poles, not exceeding 30 feet in length, are used, and the whole rake is much lighter. The price of this rake is $7.50, while the poles cost $1.50.

The third form of a basket rake is a cross between the basket and claw rakes. This rake is used both at Nantucket and on Cape Cod, but is not so popular as the other types. The basket is formed by the curve of the prongs, which are held together by two long cross-bars at the top and bottom of the basket, while the ends are enclosed by short strips of iron. This rake exemplifies the transition stage between the claw and basket types, indicating that the basket form was derived from the former. Handles 20 to 30 feet long are generally used with these rakes.

Shallow v. *Deep Water Quahauging.* — Two kinds of quahauging are found in Massachusetts, — the deep and the shallow water fisheries. This arbitrary distinction also permits a division of localities in regard to the principal methods of fishing. Although in all localities there exists more or less

shallow-water fishing, the main quahaug industry of several towns is the deep-water fishery. In all the Buzzard's Bay towns except Fairhaven and New Bedford the shallow-water fishery prevails; this is also true of the south side of Cape Cod. On the north side of Cape Cod the opposite is true, as the quahauging at Wellfleet, Eastham, Orleans and Brewster is practically all deep-water fishing. At Edgartown and Nantucket, although there is considerable shallow-water digging, the deep-water fishery is the more important.

The deep-water fishery is vastly more productive than the shallow-water industry, furnishing in 1907 118,500 bushels, compared to 23,227 bushels, or more than five times as much. The deep-water fishery, *i.e.*, the basket-rake fishery, is the main quahaug fishery of the State, and each year it is increasing, because of the opening of new beds. On the other hand, the shallow-water grounds are rapidly becoming barren from overfishing. The deep-water quahauging is harder work, requires considerable capital but has fewer working days. Naturally the earnings from this fishery should surpass those of the shallow-water industry. The deep-water quahauger averages from $5 to $8 for a working day, while the shallow-water fisherman earns only from $2 to $3 per day.

Both power and sail boats are used in deep-water quahauging, though power is gradually replacing the old method of sailing, because of its increased efficiency and saving of time. When the quahaug grounds are reached, the boat is anchored at both bow and stern, one continuous rope connecting both anchors, which are from 500 to 600 feet apart, in such a way that the bow of the boat is always headed against the tide. A sufficient amount of slack is required for the proper handling of the boat, which can be moved along this anchor "road" as on a cable, and a large territory raked. The rake is lowered from the bow of the boat, the length of the handle being regulated by the depth of the water, and the teeth worked into the sandy or muddy bottom. The quahauger then takes firm hold of the crosspiece at the end of the handle, and works the rake back to the stern of the boat, where it is hauled in and the contents dumped on the culling board or picked out of the net. In hauling in the net the rake is turned so that the opening is on top, and the mud or sand is washed out before it is taken on board. The long pole passes across the boat and extends into the water on the opposite side when the rake is hauled in. This process is repeated until the immediate locality becomes unprofitable, when the boat is shifted along the cable. The usual time for quahauging is from half ebb to half flood tide, thus avoiding the extra labor of high-water raking. Deep-water raking is especially hard labor, and six hours constitute a good day's work.

Boats. — Nearly all kinds of boats are utilized in the quahaug fishery, and are of all values, from the $10 second-hand skiff to the 38-foot power seine boat, which costs $1,500. The shallow-water industry requires but little invested capital. Dories and skiffs are the principal boats, costing from $10 to $25. Occasionally a sail or power boat may be used in this fishery. The deep-water industry requires larger and stronger boats. These are either power or sail boats, often auxiliary "cats," and their value runs anywhere from $150 to $1,500. The average price for the sail boats is $250, while the power boats are assessed at $350. At Orleans several large power

seine boats, valued at about $1,500, are used in the quahaug fishery. These seine boats are 30 to 38 feet over all, have low double cabins, and are run by 8 to 12 horse-power gasolene engines. The ordinary power boats have gasolene engines from 2 to 6 horse-power. In this way each method of quahauging has its own boats, which are adopted for its needs.

Dredging. — So far as known, dredging is never used in quahauging in Massachusetts, although it is sometimes used on sea-clam beds. It has been tried, but without success, chiefly because of the uneven nature of the bottom. The invention of a suitable dredge is necessary, and there can be little doubt that in the future, if this difficulty is overcome, dredging will be used in the quahaug fishery. In 1879 Ingersoll (8) reports in Rhode Island the use of a quahaug dredge similar in structure to our rake. Evidently this form was never especially successful, possibly because these dredges could not be dragged by sail boats.

Outfit of a Quahauger. — The implements and boats used in quahauging have already been mentioned. The outfit of the average quahauger in each fishery is here summarized: —

Deep-water Quahauging.		*Shallow-water Quahauging.*	
Boat,	$300	Boat,	$20
2 rakes,	20	Tongs or rakes,	3
3 poles,	6	Baskets,	2
	$326		$25

Season. — The quahaug fishery is essentially a summer fishery, and little if any is done during the winter. The season in Massachusetts lasts for seven months, usually starting the last of March or the first of April, and ending about the first of November. The opening of the spring season varies several weeks, owing to the severity of the weather; and the same is true of the closing of the season.

As a rule, the Buzzard's Bay industry, where digging is done in the shallow waters of protected bays and coves, using short rakes and tongs, has a longer season than the quahaug industry of Cape Cod, where the fishery is carried on in deep and open waters. With the former, the cold work and hardship alone force the quahaugers to stop fishing, a long time after storms and rough weather have brought the latter industry to an end.

The actual working days of the deep-water quahauger number hardly over 100 per season, while those of the shallow-water fisherman easily outnumber 150. The deep-water quahauger's daily earnings are two or three times the daily wages of the shallow-water quahauger, but the additional number of working days in part makes up this difference.

The quahaug season can be divided arbitrarily into three parts: (1) spring; (2) summer; (3) fall. The spring season lasts from April 1 to June 15, the summer season from June 15 to September 15, and the fall season from September 15 to November 1. These seasons are marked by an increase in the number of quahaugers in the spring and fall. The men who do summer boating quahaug in the spring before the summer people arrive, and in the fall after the summer season is over. The opening of the scallop season, in towns that are fortunate enough to possess both

industries, marks the closing of the quahaug season. These two industries join so well, scalloping in the winter and quahauging in the summer, that a shellfisherman has work practically all the year.

Marketing. — The principal markets for the sale of Massachusetts quahaugs are Boston and New York. In 1879 the Boston market, according to Ingersoll (8), sold comparatively few. At the present time the Boston market disposes of many thousand bushels annually, but nevertheless the greater part of the Massachusetts quahaugs are shipped to New York. This, again, is due to the better market prices offered by that city. Besides passing through these two main channels, quahaugs are shipped direct from the coast dealers to various parts of the country, especially the middle west. This last method seems to be on the increase, and the future may see a large portion of the quahaug trade carried on by direct inland shipments.

(*a*) *Shipment.* — Quahaugs are shipped either in second-hand sugar or flour-barrels or in bushel bags. The latter method is fast gaining popularity with the quahaugers and dealers, owing to its cheapness, and is now steadily used in some localities. When quahaugs are shipped in barrels, holes are made in the bottom and sides of the barrel, to allow free circulation of air and to let the water out, while burlap is used instead of wooden heads.

(*b*) *"Culls."* — Several culls are made for the market. These vary in number in different localities and with different firms, but essentially are modifications of the three "culls" made by the quahaugers: (1) "little necks;" (2) "sharps;" (3) "blunts." The divisions made by the firm of A. D. Davis & Co. of Wellfleet are as follows: (1) "little necks," small, 1½ to 2¼ inches; large, 2¼ to 3 inches; (2) medium "sharps," 3 to 3¾ inches; (3) large "sharps," 3¾ inches up; (4) small "blunts;" (5) large "blunts."

(*c*) *Price.* — The prices received by the quahaugers are small, compared with the retail prices. "Little necks" fetch from $2.50 to $4 per bushel, sharps and small blunts from $1.10 to $2, and large blunts from 80 cents to $1.50, according to the season, fall and spring prices necessarily being higher than in summer. The price depends wholly upon the supply in the market, and varies greatly, although the "little necks" are fairly constant, as the demand for these small quahaugs is very great. To what excess the demand for "little necks" has reached can best be illustrated by a comparison between the price of $3 paid to the quahauger per bushel, and the actual price, $50, paid for the same by the consumer in the hotel restaurants.

(*d*) *Bedding Quahaugs for Market.* — By town laws in Orleans, Eastham and Wellfleet, each quahauger may, upon application, secure from the selectmen a license, giving him not more than 75 feet square of tidal flat upon which to bed his catch of quahaugs. While no positive protection is guaranteed, public opinion recognizes the right of each man to his leased area, and this alone affords sufficient protection for the success of this communal effort, which is the first step by the people toward quahaug farming.

The quahauger needs only to spread his catch on the surface, and within two tides the quahaugs will have buried themselves in the sand. Here they will remain, with no danger of moving away, as the quahaug moves but little. The quahauger loses nothing by this replanting, as not only do the quahaugs remain in a healthy condition, but even grow in their new environment.

The result of this communal attempt at quahaug culture is beneficial. While the market price for "little necks" is almost always steady, the price of the larger quahaugs fluctuates considerably, and the market often becomes "glutted." This would naturally result in a severe loss to the quahauger if he were forced to keep shipping at a low price. As it is, the fortunate quahauger who possesses such a grant merely replants his daily catch until the market prices rise to their proper level. An additional advantage is gained by the quahauger, who at the end of the season has his grant well stocked, as higher prices are then offered. As many as 1,000 barrels are often held this way at the end of the season.

History of the Fishery. — Although reckoned inferior to the soft clam (*Mya arenaria*), the quahaug was dug for home consumption for years in Massachusetts, and but little attempt was made to put it on the market. The commercial quahaug fishery started on Cape Cod, about the first of the nineteenth century, growing in extent until about 1860. From 1860 to 1890 the production remained about constant. The production in 1879 for Massachusetts, as given by A. Howard Clark, totalled 11,050 bushels, valued at $5,525. It is only in the last fifteen to twenty years that the actual development of the quahaug fishery has taken place. The present production of Massachusetts is 144,044 bushels, valued at $194,687. To the popular demand for the "little neck" can be attributed the rapid development of the quahaug industry during the last ten years. This development has furnished employment for hundreds of men, and has given the quahaug an important value as a sea food. What it will lead to is easily seen. The maximum production was passed a few years ago, constant overfishing caused by an excessive demand is destroying the natural supply, and there will in a few years be practically no commercial fishery, unless measures are taken to increase the natural supply. Quahaug farming offers the best solution at the present time, and gives promise of permanent success.

Not only has there been an increase in production, but also an increase in price, which has more than doubled between 1888 and 1902, and has alone supported a declining fishery in many towns, making it still profitable for quahaugers to keep in the business, in spite of a much smaller catch. The advance in price is due both to the natural rise in the value of food products during the past twenty-five years and also to the popular demand for the "little neck," or small quahaug.

Statistics of the Quahaug Fishery. — In the following table the towns are arranged in alphabetical order, and the list includes only those towns which now possess a commercial quahaug fishery. In giving the number of men, both transient and regular quahaugers are included. In estimating the capital invested, the boats, implements, shanties and gear of the quahauger are alone considered, and personal apparel, such as oil-skins, boots, etc., are not taken into account. The value of the production for each town is based upon what the quahaugers receive for their quahaugs, and not the price they bring in the market. The area of quahaug territory given for each town includes all ground where quahaugs are found, both thick beds and scattering quahaugs.

Town.	Number of Men.	Capital invested.	Number of Boats.	Number of Dories and Skiffs.	1907 Production.		Area in Acres.	Value of Yield per Acre.
					Bushels.	Value.		
Barnstable,	25	$850	–	25	2,500	$3,700	950	$3 95
Bourne,	46	1,000	–	46	5,400	8,400	2,500	3 36
Chatham,	50	5,750	25	25	6,700	10,000	2,000	5 00
Dennis,	15	150	–	10	500	950	200	4 75
Eastham,	25	8,000	12	–	10,000	11,500	4,000	2 87
Edgartown,	70	12,000	42	18	20,000	32,000	1,800	17 77
Fairhaven,	115	5,000	11	100	15,000	16,500	3,000	5 50
Falmouth,	–	–	–	–	100	115	400	29
Harwich,	7	200	–	7	1,500	2,550	100	25 50
Marion,	19	250	–	19	800	1,500	400	3 75
Mashpee,	7	70	–	5	250	285	400	71
Mattapoisett,	28	500	–	28	800	1,500	750	2 00
Nantucket,	48	6,750	30	10	6,294	8,487	5,290	1 60
Orleans,	75	25,000	30	25	33,000	41,350	1,500	27 56
Wareham,	50	1,000	–	50	6,000	10,500	1,300	8 08
Wellfleet,	145	27,500	100	–	33,000	41,350	2,500	16 54
Yarmouth,	20	240	–	10	2,200	4,000	1,000	4 00
Totals,	745	$94,260	250	378	144,044	$194,687	28,090	$6 93 [1]

[1] Average.

The Laws.

In the past there has been a scarcity of quahaug legislation as there has been little demand for the protection of this mollusk; but within a few years the legal regulation of the quahaug fishery will become a most important part of the shellfish legislation of Massachusetts. The quahaug industry is entering upon a new phase of existence, the cultural stage, and the development of the industry along such lines will necessarily entail numerous laws governing the leasing, planting, pollution and sale of quahaugs. For this reason it may be well to consider what has already been done in a legislative way for the protection of the quahaug fishery.

Little direct quahaug legislation has been passed, as the quahaug usually has been included in general laws with other commercial shellfish. The reason for the lack of legislation is probably due to the recent growth of the quahaug fishery, which has only in the past fifteen years developed into an important industry.

Previous to 1904 the quahaug, with the clam, oyster and scallop, came in the general acts under the term shellfish. The general acts were of several kinds: (1) town regulation; (2) permits; (3) seizure in

vessels; and (4) protection of the shellfisheries by limiting the catch, place and time of taking.

In 1874 occurs the first mention of the word quahaug in a legislative act "to regulate the shellfisheries in the waters of Mount Hope Bay and its tributaries," whereby the selectmen of the towns bordering on Mount Hope Bay were permitted to grant licenses for the cultivation of clams, quahaugs, scallops and other shellfish to any inhabitant. It seems strange that such an advanced and beneficial act should have been passed at that early period, since it was clearly before its time, as is shown by its repeal the following year. It is only within the last two years that similar legislation has been passed for the quahaug, as illustrated by the act of 1909, which permits the granting of leases for the growing of quahaugs by the selectmen provided the town meeting has voted to adopt the general law. The act of 1874, although it applied only to the Narragansett Bay section of Massachusetts, brings out clearly the fact that the cultivation of shellfish is no new project as it was considered of practical importance thirty-five years ago.

In 1880 the word quahaug again appears in the general act whereby the Commonwealth gave to the towns and cities their present oversight and power "to control and regulate the taking of eels, clams, quahaugs and scallops." This act was later amended by the Acts of 1889, but the general terms were not changed, and the present law differs but slightly. As the seacoast towns hold their control over the shellfisheries as a direct trust from the Commonwealth, it is their duty to preserve the fisheries, while the Commonwealth should see that the towns take the proper care of their natural shellfish resources. Certain towns should be deprived of the rights which they are abusing in neglecting one of the great resources of the public wealth, which belongs not only to the inhabitants of the seashore communities but to *every resident* of this Commonwealth. At the present time, owing to a certain self-satisfaction and fear of outside influence, the majority of fishermen prefer the present system of town control, no matter if the shellfisheries suffer, and until public opinion is favorable for the utilization of the quahaug fishery for every inhabitant of the Commonwealth, both fishermen and consumer, State control is not desirable.

In 1900 occurred the first special quahaug legislation, in the form of an act forbidding in the towns of Swansea and Somerset the capture of quahaugs less than 1½ inches across the widest part. Since that time five other laws relating to the quahaug fishery have been enacted, in all three town and three general. The following features are illustrated by these acts: —

Limiting the Size of Quahaugs captured. — The capture of quahaugs under 1½ inches across the widest part was forbidden by law in 1900 in the towns of Swansea and Somerset, in 1901 in Berkley, in 1903 in Edgartown, and in 1904 in Eastham, Orleans and Wellfleet. This

law has also been adopted by other towns under the regulation of the selectmen, and is to be commended for the protection afforded to the home industries, as the gain for leaving the small quahaugs is many times the profits on the small seed. In this connection attention is again called to the shipment in the past of the small seed from Nantucket, Chatham and New Bedford to localities outside the State, where they are replanted, with a return, in one year's time, of about 5 bushels for every bushel planted.

Permits. — In Eastham, Orleans and Wellfleet the selectmen are empowered to issue permits for the capture of the quahaug, while in Edgartown, Berkley, Swansea and Somerset the permits are issued for shellfish in general. Often the towns are very slack about the enforcement of requiring permits, although Edgartown is to be highly commended for the excellent manner of regulating, by inspectors, her shellfish permits. These permits are given at the discretion of the selectmen, and are supposed to require six months' residence in the town. Different prices are charged for these permits: in Edgartown, $2; in Wellfleet, $1; in Berkley, although empowered by the Acts of 1901, no permits are given; in Somerset and Swansea only clam permits are given. The provisions of the Edgartown permit limit the catch to 4 bushels from sunrise to sunset, no more than 2 of which can be "little necks." The Wellfleet permits limit the daily catch to 4 barrels per man.

Bedding Quahaugs. — In Eastham, Orleans and Wellfleet the selectmen may give, for a period not over two years, under such conditions as they may deem proper, to any inhabitant of the respective towns, licenses to bed quahaugs in any waters, flats or creeks where there is no natural quahaug bed, not covering more than 75 feet square in area, and not impairing the private rights of any person or materially obstructing any navigable waters. The object of this law was to make possible the advantage of a favorable market, as the quahauger could bed his catch until the market brightened and the price went up, otherwise he would be compelled to ship at a low figure. Undoubtedly the originators of this act did not foresee that in this way they had taken the first step toward quahaug farming, as the success of bedding quahaugs has demonstrated to the quahaugers of this section the practical benefits which would be derived from quahaug culture.

Contaminated Waters. — One of the detrimental results of civilization has been the pollution of the public waters in Massachusetts, which appears to us most unfortunate, as in the light of present-day knowledge, such a state of affairs could be readily avoided. The tendency of the past has been to dispose of sewage, manufacturing wastes and other refuse by allowing it to flow into the nearest streams. In this way some of the finest rivers in the Commonwealth, the Merrimac, Connecticut, Taunton, Charles and Mystic, have had their fisheries ruined.

Pollution has not been confined to the fresh water alone, but has for commercial purposes ruined the shellfish beds of many salt-water harbors. In several cases, particularly at Boston, Lynn and New Bedford, certain parts of the harbors have been closed by the State Board of Health in the interest of the public health.

For years the relation of the oyster from infected beds to epidemics of typhoid fever has been known and definitely traced. The same is true of the clam and quahaug, particularly the "little neck," which is consumed raw. The quahaug, when feeding, acts as a living filter, since all the microscopic forms in the water, taken through the incurrent siphon, are strained out by the cilia on the gills. Thus, if the typhoid bacilli are present in the water, as is the case when sewage from the houses of typhoid patients empties near the shellfish beds, they are collected by the feeding quahaug. The person partaking of a raw quahaug from this locality would be ingesting a concentrated collection of germs, with perhaps serious results. Cooked quahaugs are more free from germs, and if thoroughly cooked are possibly wholesome, as a certain temperature is fatal to the bacillus. Unfortunately, cooking cannot always be relied upon to reach the requisite temperature.

In 1901 it was enacted that the Commissioners on Inland Fisheries and Game (now the Commissioners on Fisheries and Game), whenever so requested in writing by the State Board of Health, should prohibit the taking of oysters, clams, scallops and quahaugs from the tidal waters or flats of any part of the Commonwealth for such period of time as the board of health might determine. The penalty for violation was, for first offence not less than $5 and not more than $10, and not less than $50 nor more than $100 for each subsequent offence. Unfortunately the beneficial effect of this law, namely, the protection of the public health by the closing of sewage-polluted areas, was rendered void by the passage of a bill in 1907 permitting the taking of shellfish from these areas for bait, upon securing permits from the board of health. Although the law provides heavy penalties for buying and selling, experience has shown the impracticability of effective enforcement on account of the ease with which (1) proofs are destroyed by the violator, and (2) the difficulty of tracing any lot of polluted shellfish to prove that their ultimate destination, perhaps a week or two hence, is human food and not fish bait. Very few quahaugs are used for bait, and the absurdity of the situation is shown when in the case of the Acushnet river over 1,100 permits to take quahaugs for bait have been issued by the New Bedford Board of Health. In such cases as the Acushnet River, where seed quahaugs are abundant, a means should be found to permit the sale of the seed for planting purposes *within the Commonwealth* by the passage of a special act for the town of Fairhaven and city of New Bedford. But until the laws permit the planting of such quahaugs it is impossible to adequately solve the question of obtaining seed from the polluted areas. Transplanted

to pure water these mollusks will readily purify themselves from all contamination.

Biological Investigation. — In 1905 the Commissioners on Fisheries and Game were empowered to make a biological investigation and report as to the best methods, conditions and localities for the propagation of quahaugs. The results of that investigation are embodied in this report.

Planting, Cultivation and Bedding of Quahaugs. — In 1909 the selectmen of towns or the mayor or aldermen of cities, provided the act is approved by the city council or by the voters of the town at an annual or special town meeting, are empowered to issue written licenses for the purpose of planting and cultivating quahaugs upon and in the flats and creeks below mean low-water mark, for a term of not more than ten and not less than five years. The important fact that up to the present time no town has taken advantage of this act, which permits practical quahaug culture being carried on, is another proof of the inability of the coast towns to properly adjust their point of view toward the practical means not only of preserving their natural supply from extinction but also of building up an extensive and profitable business for the inhabitants.

Date.	Kind.	Provisions.
1900, . .	Special town, . .	No quahaugs less than 1½ inches to be taken in Swansea and Somerset.
1901, . .	Special town, . .	No quahaugs less than 1½ inches to be taken in Berkley.
1901, . .	State, ...	No quahaugs to be taken from the waters closed by the State Board of Health.
1903, . .	Special town, .	No quahaugs less than 1½ inches to be taken in Eastham, Orleans and Wellfleet. Selectmen of these towns empowered to grant permits for taking quahaugs. For bedding quahaugs, grants not exceeding 75 feet square, given on the flats and creeks.
1905, . .	State, ...	Biological investigation of quahaug fishery by the Fish and Game Commission.
1909, . .	State, ...	Planting, cultivation and bedding of quahaugs.

The Food Value.

The market value of the quahaug except in the case of "little necks," depends rather upon the quality of the meat than on the appearance of the shell. In the growth experiments the ratio of the meats to the shell, in other words, the "fattening," has been little considered. While an increase in shell naturally presupposes a corresponding increase in the soft parts, it does not always follow that the quality of the soft parts has improved. Oyster planters bed oysters to obtain rapid growth, and then transplant the stock to other waters to "fatten" for the market, because localities of rapid growth are not always suitable for fattening purposes. Naturally the ratio between shell and

meat varies in the different localities, owing to the environment, food, amount of lime in the water, etc. The prospective quahaug culturist should therefore determine not only the growing property of his grant but also the quality of the product.

Owing to the heavy shell the actual amount of food is but a small per cent. of the total weight of the quahaug. To find the ratio between the meat and shell, a series of determinations on various sized quahaugs were made in three localities, Buzzard's Bay, the Islands and the north side of Cape Cod. For this purpose quahaugs were taken from Fairhaven, Nantucket and Wellfleet. Four sizes of "sharps," 10 each, measuring 55, 65, 75 and 85 millimeters, were taken for comparative purposes in each locality. Whenever possible the weight of "blunts" of similar sizes was also recorded for comparison with the "sharps." The method of work consisted in (1) obtaining the correct sizes from the fresh catch, care being taken to select no deformed specimens; (2) the determination of the total weight; (3) the removal of the meats and fluid; (4) determination of the weight of the meats; (5) records of the natural conditions of the beds where the quahaugs were taken; (6) determination of the volume of the different parts by water displacement to serve as a check on the weighing.

Chemical Composition. — As a food the quahaug ranks next to the scallop and ahead of the oyster in proteins, carbohydrates and minerals. The following figures are from the tables of Professor Atwater, rearranged by Langworthy (15). The food value of the quahaug in the shell, removed from the shell and canned is compared with the scallop, oyster and clam.

	Refuse, Bone, Skin, etc. (Per Cent).	Salt (Per Cent.).	Water (Per Cent.).	Protein (Per Cent.).	Fat (Per Cent.).	Carbohydrates (Per Cent.).	Mineral Matter (Per Cent.).	Total Nutrients (Per Cent.).	Food Value per Pound (Per Cent.).
Oysters, solids,	–	–	88.3	6.1	1.4	3.3	.9	11.7	235
Oysters, in shell,	83.3	–	15.4	1.1	.2	.6	.4	2.3	40
Oysters, canned,	–	–	85.3	7.4	2.1	3.9	1.3	14.7	300
Scallops,	–	–	80.3	14.7	.2	3.4	1.4	19.7	345
Soft clams, in shell,	43.6	–	48.4	4.8	.6	1.1	1.5	8.0	135
Soft clams, canned,	–	–	84.5	9.0	1.3	2.9	2.3	15.5	275
Quahaugs, removed from shell,	–	–	80.8	10.6	1.1	5.2	2.3	19.2	340
Quahaugs, in shell,	68.3	–	27.3	2.1	.1	1.3	.9	4.4	65
Quahaugs, canned,	–	–	83.0	10.4	.8	3.0	2.8	17.0	285
Mussels,	49.3	–	42.7	4.4	.5	2.1	1.0	8.0	140
General average of mollusks (exclusive of canned).	60.2	–	34.0	3.2	.4	1.3	.9	5.8	100

The Meat. — The entire solid contents of the quahaug is used for food, whereas with the scallop only the adductor muscle or "eye" is taken. The meat is either eaten raw, when the quahaugs are served as "little necks" on the half shell, or cooked in various ways.

With advancing age, as is shown by the increase in the weight of the meat of the "blunt" when compared with the same sized "sharp," the flesh becomes tough and of a yellow color, which renders it less edible than the tender "little neck."

Comparison by Localities. — In the following table the average quahaug of 70 millimeters (2⅘ inches) for Wellfleet on Cape Cod, Nantucket on Vineyard Sound, and Fairhaven on Buzzard's Bay is shown. The per cent. by weight of the different parts was determined by the average of the four sizes, as described above. The important factor is the per cent. by weight of the solid contents.

The average gives the value for the 70-millimeter quahaug for the State. From 100 pounds of quahaugs by weight the consumer would obtain 13.57 pounds of meat.

Locality.	Total (Per Cent.).	Shell (Per Cent.).	Solid Contents (Per Cent.).	Fluid Contents (Per Cent.).
Wellfleet,	100	62.98	12.12	24.90
Nantucket,	100	63.09	13.53	23.38
Fairhaven,	100	61.33	15.07	23.60
Average,	100	62.47	13.57	23.96

The Food Value of the Quahaug and Scallop. — In comparing the food value of the scallop and quahaug by weight it is necessary to eliminate the fluid in the shell from consideration, as it is variable with the scallop. Again, only the adductor muscle is eaten in the scallop, while the entire solid contents of the quahaug is consumed. When the weight of the shell and the edible portion are considered, it is interesting to note that the amount of edible materal in both shellfish is practically the same in per cent. by weight, being 17.85 per cent. for the quahaug, and 17.77 per cent. for the scallop. Since the weight of the quahaug's shell is 82.15 per cent. and the scallop's but 49.43 per cent., the non-edible soft parts of the scallop amount to 32.80 per cent.

Shell. — The amount of lime in the water and age of the quahaug determine the weight of the shell, although the character of the soil appears to have an indirect effect upon the nature of the lime structure. Likewise, the rate of growth is important, as the slow-growing quahaugs apparently have thicker shells than those in more favorable localities. As the size of the quahaug increases from 55 to 85 millimeters the weight of the shell in per cent. of the total weight increases .06 per cent. for each millimeter gain in length, the meats .04 per cent., while

the fluid contents decreases .1 per cent. The shell of a "blunt" weighs over one and one half times that of a "sharp" of the same size.

Unlike the scallop the quahaug is seldom put through the process of "soaking," as it is usually shipped to market in the shell. Occasionally when "shucked" the volume is increased by judicious "feeding" with fresh water. The small quahaugs are more responsive to "soaking" than the old tough specimens, but as they are generally served on the half shell this process is seldom used.

"Soaking" is accomplished by placing the quahaug meats in fresh water, thereby causing a swelling of the tissues, which increases the bulk about one-third. The principal change is attributed to osmosis, which distends the tissues. It was found that after twenty-four hours of soaking the tissues lost the water and gradually returned to their normal weight.

THE RATE OF GROWTH.

Object. — The experiments on growth were conducted with the following objects: (1) to ascertain the normal rate of growth; (2) to find the average length of life; (3) to determine the length of time necessary for the production of a marketable quahaug; (4) to discover practical methods of artificial culture and propagation in order to replenish the barren flats and to check the decline of the natural supply; (5) to obtain information of value to prospective quahaug culturists.

General Plan. — The principal results of these experiments have already been given in previous reports and this paper merely presents the work in detail showing the general method of obtaining the data. With the limited appropriation available $500 per year it was impossible to conduct the investigation in as extensive and comprehensive a manner as could have been desired. In order to obtain satisfactorily the general growth for Massachusetts and the effect of environment, such as soil, current, tide, depth of water, etc., it was necessary to have a large number of experimental plots. As means were limited, the greater part of these beds were of small size, less than 1/1000 of an acre, since it was considered advisable to plant a large number of small plots, covering a variety of conditions, rather than a few large costly beds, as small areas seem to furnish, for all practical purposes, a true index of growth in any locality. In accordance with this plan 187 small experimental beds were planted along the Massachusetts coast, and records of their growth were taken at stated intervals over a period of five years. By planting quahaugs which were five years old, as well as younger ones, at the beginning of the investigation the growth of the quahaug has been determined not only for the five years but for a much longer period. The growth experiments of Kellogg (2) were taken as a basis for this investigation, and the work carried out upon the lines indicated by that investigator. The experiments have been conducted on a practical commercial basis, as the main object was the increasing of the natural supply.

Methods of Work.

Localities. — Five places on the Massachusetts coast were chosen as representative localities: (1) the island of Nantucket; (2) Monument Beach on the shore of Buzzard's Bay; (3) Plymouth harbor, representing the northern commercial range of the quahaug; (4) Wellfleet harbor, the center of the greatest quahaug area in the Commonwealth; and (5) Monomoy Point, in the town of Chatham, as representing the south side of Cape Cod. As it seemed best to concentrate the work as much as possible, the greater part of the experiments were conducted in the last two localities, only a few beds being planted in the other three. These two places, Wellfleet and Monomoy, may be considered as fairly representative of the two great quahaug areas, — the north and south sides of Cape Cod.

Experimental Beds. — The first experimental plots were laid out in terms of the acre, 1/1000 of an acre being the usual size. The later beds were made even smaller, 1/4000 of an acre. The number of quahaugs corresponded to the size of the bed, and in most cases they were thinly planted as only in special instances was crowding necessary for experimental purposes. The planted quahaugs if they were fortunate enough to escape the raids of fishermen and summer residents, were measured annually, and the rate of growth recorded as long as the bed escaped destruction by man or nature. The beds were marked by stakes and protected by signs, which stated briefly that the enclosed plot was under control of the Commonwealth for experimental purposes, as provided by chapter 327, Acts of 1906. Less difficulty was found in protecting the quahaug experiments than similarly planted clam beds, which were often destroyed through human agency. The first beds were laid out in the form of pens, made by sinking boards in the soil so that they projected slightly above the surface. Owing to the difficulty of sinking the boards, the use of this type of bed was limited to shallow water. Later, when records of the migration of the quahaug were obtained, such precautions were found unnecessary, as the quahaug generally remains where planted.

The method of planting was extremely simple, the quahaugs being evenly distributed over the surface of the bed where, in a short time, according to the temperature of the water, they would burrow in the soil. In shallow-water beds and in special cases where greater accuracy was desired the quahaugs were buried by hand in the soil.

Owing to the impossibility of obtaining by raking all the quahaugs in beds such as above described, a factor which would make for inaccuracy, a method of planting was tried in which boxes of various sizes, filled with sand, were used with excellent results. The mollusks, placed in these boxes, could be lowered to any depth in the desired locality, in such a manner that they could readily be taken up and all the quahaugs obtained.

The beds were divided into two classes, below low-water mark and between the tide lines. Each bed was designed to illustrate a particular point in regard to conditions, favorable or unfavorable, which influence the growth of the quahaug, and for this reason different locations were tried. A record of each bed was kept, giving all facts about its natural location, records of growth, etc. By a comparison of these beds, the favorable and unfavorable conditions for quahaug culture could be ascertained. The beds were put in both good and poor places, on natural quahaug ground and on barren area, as often through the failure of a bed the cause may be discovered and a remedy suggested.

The Seed. — All sizes of quahaugs were planted in order to obtain data on the growth of the animal for a long period and to arrive at some conclusion as to the length of life. In general, the smallest obtainable were used, the usual size being 1 to 1½ inches. To satisfactorily obtain a complete record of the growth of this animal it was necessary to have quahaugs extremely small. Although "little necks" and even slightly smaller quahaugs could be procured at Edgartown, no quahaugs of small size could be obtained at the regular quahauging places in sufficient numbers for planting. This was due not so much to the lack of quahaug seed as to the impossibility of raking them in any great depth of water. This difficulty was encountered only at the start, as later the small quahaugs were caught in the spat boxes at Monomoy Point. In the fall of 1905, by a fortunate chance a place was found at Nantucket where quahaugs of extremely small size, running from 6 to 8 millimeters, could be obtained as late as November 1. The seed thus obtained furnished the nucleus for the growth experiments at Monomoy Point, and in 1906 another stock was obtained from the same place.

The following description of the locality at Nantucket where the small quahaugs were obtained in 1905 and 1906 is taken from notes made at that time:—

Coatou Point, consisting of a narrow strip of sandy beach, lies directly across the harbor from the village of Nantucket. On one side is a salt-water pond, connected with the harbor by a stream through which the tide flows into the pond. The stream has a bed of coarse sand and is protected by a sand bar at its mouth. The sand in the lower part of the stream, which extends for about 50 yards in a crooked course, is fine and clear white. Half way up there is a stretch of fine gravel and above this coarse sand. At the upper part of the stream, where it nears the pond, the sides rise abruptly in banks lined with heavy thatch, and are heavily set with the ribbed mussel (*Modiola plicatula*), while large bunches of the common mussel (*Mytilis edulis*) lie in the bed of the stream. In this part of the creek the quahaugs were abundant, and could be exposed by raking the surface of the sand. Many of these small quahaugs had a bit of green algæ attached to the beak of the shell, and were especially numerous in the clumps of mussels. Quahaugs could be obtained as large as 1¾ inches, but no larger, while the

majority were small (6 to 8 millimeters). The locality is evidently one of slow growth, judging from the appearance of the quahaugs and from the fact that no increase in growth between August and the following spring could be noticed. The method of gathering these small quahaugs was by hand and by sifting the sand through fine mesh screens, a slow process, as only 200 could be gathered per hour by one person.

In the following year, 1906, the seed under 1½ inches was obtained at Edgartown in Katama Bay. The quahaugs were raked in the usual manner with a basket rake of the Edgartown type; but instead of washing the mud and sand from the rake when it was drawn to the surface of the water, as is customary, the contents were dumped at once on the culling board, where the small quahaugs, which otherwise would have slipped through the meshes of the rake, were separated from the débris.

Another method of obtaining seed was by means of the box spat collectors on the raft at Monomoy Point. The subject of spat collecting has already been discussed, and the method of obtaining the young quahaugs described. It was possible to obtain the desired sizes, even very small specimens. In this way a study of the early life history proved advantageous for the cultural experiments, as quahaugs could be hatched for planting purposes.

Measuring the Quahaugs. — For convenience the measurements were taken in the metric system. Three methods of measuring were used: (1) rule; (2) callipers and rule; (3) triangular measuring instrument, such as pictured in the report on the "Scallop Fishery," 1910. The first two were used only for a short time at the beginning of the work and soon gave place to the third method, which proved more satisfactory in speed and accuracy. This instrument consists of an inverted triangle, formed by two strips of metal welded together at the apex of the triangle and joined at the base by a short cross-piece. The whole structure is made of brass, except the braised joint, and can be made as light as desired, although there is danger of a heavy blow rendering a light instrument inaccurate. Several sizes are used in the work, the most convenient having a base measuring 3 inches. The sides of the triangle are scaled in the metric system on one face and in fractions of inches on the other, the divisions corresponding to the millimeter markings on the ordinary rule, being about 5 millimeters apart, thus enabling the operator to make easier and more accurate readings. When measuring, the triangle is held with the base away from the body, and the object is brought down the narrowing sides until it strikes, at which point the measurement is read.

Three measurements were made of each quahaug, *length,* along the anterior posterior axis; *width,* from the umbones to the edge of the shell, along the dorso-ventral axis; and *thickness,* from valve surface to valve surface, along the lateral axis. After a sufficient number of

measurements were taken, a table was formulated by which the corresponding width and thickness for any given length might be calculated. The use of this table eliminated the necessity of taking more than the length measurements.

An easy method of recording the growth of the planted quahaugs consisted in notching the edges of the shell with a file. The mark thus made would remain permanently on the shell, showing the increase in growth. This efficient method was originally used by Dr. A. D. Mead of the Rhode Island Commission of Inland Fisheries in his experiments on the soft clam (*Mya*), and has proved very satisfactory in our quahaug experiments. It has been used not only as a check upon other measurements, but, in connection with the table of length and width, has provided a permanent record for successive yearly growths.

The simple statement of the gain in length does not adequately express the actual increase in the bulk of the quahaug, which should be indicated in terms of volume. A quahaug which grew in one year from a length of 1 inch to a length of 2 inches, a gain of 1 inch, does more than merely double in size, as the figures would seem to indicate. When the gain in volume is considered by comparing the water displacement of the two sizes, it is found that the volume of the 2-inch quahaug is over seven times that of the 1-inch, which gives the true increase. The quahaug shuts its shell closely enough to be water tight, and it is relatively an easy matter to accurately obtain its water displacement, a process impossible with the soft clam and scallop, which have more or less open shells. A table (see Table 3) of volume by water displacement and number per quart was made for each length from 1 to 88 millimeters, several hundred specimens being used for each size, except for the sizes under 6 millimeters. The individual quahaugs vary greatly, some being thick, others thin, some narrow, others wide. For this reason it was necessary to use a large number of quahaugs of each size, and after plotting the results on co-ordinate paper to form a uniform curve for the volume.

Monomoy Experiments.

During the period from 1905 to 1910 growth experiments were conducted in the Powder Hole, a sheltered harbor of salt water situated at Monomoy Point, Chatham, at the elbow of Cape Cod. In former years the Powder Hole was a spacious harbor where a hundred vessels could anchor, but the sand bars have so shifted that at the present time nothing remains but an almost enclosed body of water, of perhaps 3 acres, connected with the ocean on the bay side by a narrow opening through which a dory may enter at high tide. The opening changes constantly, owing to the shifting nature of the sand, and has successively worked from the south to the north side, closed and re-opened again at the south at intervals of one and a half years. A large part of the original harbor is now either dry land or salt marsh, while on

the north and west side is a sand flat of 3 acres, which up to 1910 contained an abundant quantity of soft clams. The harbor itself is slowly diminishing in size, due to the encroachment of the sand, and will doubtless eventually become a small pond, not connected with the ocean. By referring to Fig. 31 the location of the flats and experiments can be seen.

The water on the north and west sides averaged from 15 to 18 feet in depth, gradually shoaling to the south and east. In the shallow water the soil was covered with an abundant growth of eelgrass. The rise and fall of the tide was about $1\frac{1}{2}$ feet on the average, but extremely erratic, as the force and direction of the wind and the position of the opening were important in determining the amount of water passing through the narrow inlet. The location and depth of the opening made it possible for the clam flat to be constantly under water for weeks, while at other times several days might pass with the water barely covering the flats. At such times the water was over the flats for only a brief period, probably not averaging much over five hours out of the twenty-four. Naturally, the amount and frequency of the tidal flow affected the salinity of the water, which varied somewhat with the influx of the tide. The amount also varied with the high or low running tides, as a certain height had to be reached before water would flow through the inlet.

The Powder Hole, which was taken by the Commonwealth for experimental lobster hatching, proved an excellent locality for experiments on the life and growth of the quahaug, as it was a natural breeding ground. In addition to the quahaugs naturally bedded in this body of water, additional seed was planted for experimental purposes. A small laboratory was erected on the shore, and a raft 20 feet long by 10 feet wide (see report on the "Scallop Fishery," 1910) was securely moored in the deepest part of the harbor.

Box Experiments. — Two main classes of experiments were undertaken, (1) bed and (2) box, which differ only slightly, the box form being a more convenient modification of the experimental bed previously described. This form consisted of small grocery boxes filled with sand and supplied with rope handles, by which they could be let down in any depth of water, either suspended from the raft or placed on the bottom in any part of the Powder Hole, where they could be raised by a line or a long hooked pole whenever desired. The advantage of the experimental box over the bed lay first, in greater accuracy, as it permitted the operator to obtain each time the same number of quahaugs that he planted, a thing that it is almost impossible to do in a planted bed, where the quahaugs must be raked under water; secondly, it furnished a convenient means of handling; and thirdly, it permitted the planting of numerous small beds, equally as efficient from a practical standpoint, under a variety of natural conditions in the different parts of the Powder Hole.

The box experiments were divided into four classes: (*a*) rack boxes placed on posts; (*b*) boxes in the shallow water near the shore, at a depth of from 1 to 5 feet; (*c*) boxes in deep water, 10 to 18 feet; and (*d*) boxes suspended by ropes from the raft. In all cases, especially on the raft, the boxes were made as strong as possible to withstand the strain of lowering and taking up. The boxes could be used only one year, as the ship worms (Teredo) render the wood unfit for service.

The method of planting a box experiment is comparatively simple. Rope handles are stretched diagonally from end to end, the number of the experiment carved on the side of the box, and the box filled one-half to two-thirds full of clean sand from the shore. The dimensions of the box and the height of the sides above the sand are recorded. The quahaugs, which have previously been measured and notched by a file on the edge of the shell, are either placed on the surface of the sand and allowed to burrow when the box is under the water, or are placed in their natural position under the sand. The box is then lowered at the desired locality.

(1) *Rack Boxes.* — This group comprises the first box experiments, which were started in October, 1905, and continued until October, 1908. These experiments have been grouped together as they comprise all the box experiments of 1905. During the first ten months these boxes were not on the raft, but were located in a different part of the Powder Hole, under circumstances which will be briefly described as follows: —

Wooden boxes of the same length and as nearly as possible the same size were arranged so as to slide between two upright posts about 8 feet long driven firmly in the bottom in from 5 to 6 feet of water. At intervals on the posts were wooden pins, so adjusted that they could be withdrawn at will. These pins furnished a resting place and support for the boxes. Thus the boxes could be raised or lowered for examination at any time. The posts were driven down so that the tops were from 1½ to 2 feet below the surface of the water at low tide, to prevent their being carried away by the ice. To the ends of the boxes were attached galvanized iron handles 3 by 4 inches, which, passing over the posts, made the runners for the boxes. Considerable difficulty was encountered in putting down the posts in getting them the right distance apart, so the boxes would slide easily. One box was used to set the posts and the others lowered after the posts were in position. The boxes were placed in sets of two and three, the former being found more advantageous.

The natural conditions of the quahaugs which were planted in these boxes were especially favorable. The location was in the northeast end of the Powder Hole, as is shown in Fig. 31, at the edge of the deep water, or where the old channel once existed. The bottom was mud covered with thin eelgrass, while the depth of the water at low tide

averaged $5\frac{1}{2}$ feet. The sand in the boxes was taken from the exposed flats of the Powder Hole, and was coarse and firm. Raised as they were from the bottom at various heights, the quahaugs were entirely free from the influence of the dead eelgrass, and were able to get a better circulation of water than if resting on the bottom. The sand in the different boxes did not extend flush with the top, but varied from $1\frac{1}{2}$ to 5 inches from the top of the box, leaving a projecting rim. When taken up the sand in the boxes had a muddy appearance at the surface, due to the settling of matter floating on the water. The depth of water over the boxes varied with their location, since all the racks were below low-water mark, and were never exposed. No means were at hand for obtaining the exact rate of current over these experiments, but the circulation was good, and while perhaps not as swift as at the raft was all that could be desired by the quahaug planter. The density varied with the influx of the tide from 1.021 to 1.025.

(2) *Shallow-water Boxes.* — The boxes were somewhat larger than the deep-water boxes, as they could be more easily handled. These boxes were located principally on the south and east sides of the Powder Hole, both on clear bottom and in eelgrass. It is interesting to note that the rate of growth in the boxes was more rapid than for quahaugs in the natural soil in the same locality.

(3) *Deep-water Boxes.* — These boxes were of small size, for convenience in raising. Two methods of raising them were tried. Where the water was sufficiently shallow to permit the box being seen, the pole with hook was used. In the deeper water a rope and small wooden buoy were attached to the box.

(4) *Raft Boxes.* — A raft, 20 feet long by 10 wide, was moored in the Powder Hole near the flat on the north side, where the deepest water and best circulation were obtained. It was provided with a central well and four trap-doors, by means of which the boxes could be lowered to any depth up to 18 feet. The raft was used only during the summer months, and was hauled on land for the winter, the box experiments being transferred for winter to water deep enough to escape the ice. During the winter of 1906 to 1907 a heavy rope frame on posts was placed under the water at a depth of $2\frac{1}{2}$ feet from the surface. On this framework, primarily intended for wire scallop cages, were suspended a number of quahaug boxes, while others were placed on the ground in the same locality at a depth of 11 feet.

The natural conditions on the raft were especially favorable for quahaug growth, and extremely good results were obtained. The position of the raft was such as to receive the full benefit of the incoming tide as it passed through the opening over the flat, bringing with it the abundant diatomous food accumulated on the sand. In this way the circulation of the water in the vicinity of the raft was the best in the Powder Hole, and accounts for the better growth in the raft boxes.

In addition to the box experiments, quahaugs were also placed in

wire cages or baskets, and their growth obtained out of the sand. These cages were made of various sized wire mesh, from $\frac{1}{4}$ to $1\frac{1}{4}$ inch, according to the size of the quahaugs, and usually measured $1\frac{1}{2}$ by 1 by $\frac{1}{2}$ feet. They were suspended from the raft in the same manner as the boxes. For the very small quahaugs a series of jars were suspended, a few quahaugs in each jar.

Experimental Beds. — The experimental beds can be divided into two classes, (1) between the tide lines, (2) below low-water mark. The tidal beds were located in the different parts of the clam flat in connection with clam experiments (Fig. 31). The first of these beds was put out in October, 1905, and the last taken up in 1910. The main results are shown by the comparison of growth between the tide lines only one-fifth of the time under water and on the raft under nearly the same conditions. The first of these beds were in the form of pens made by sinking boards into the sand, but the later ones were planted without bounds of any sort, as it was found that the quahaugs did not travel far.

The beds below low-water mark were mostly confined to the east and south side of the Powder Hole, in shallow water from 2 to 4 feet deep, both in clear spaces and on eelgrass bottom. The entire number, six, planted in 1905 and 1906, were in the form of pens, and varied in size from $\frac{1}{1000}$ to $\frac{1}{100}$ of an acre. In all these beds the rate of growth was slow.

The growth experiments at Monomoy, as already shown, were grouped into the raft and bed classes. The two kinds of experimental beds, between the tide lines and below low-water mark, were continued from 1905 to 1910. The raft experiments, however, were separated into two series, the first during the four years from 1905 to 1908, when the main laboratory was at Monomoy Point, and the second during 1909 and 1910. The object of the first series was to determine the average rate of growth and methods of planting; the second, the growth of old quahaugs and blunts.

Plymouth Experiments.

Three beds of quahaugs, Nos. 118, 186 and 187, were planted on the flats of Plymouth harbor in connection with experiments on the soft clam (*Mya arenaria*). The experimental beds, situated between the tide lines, were located on Grey's and Egobert's flats in the town of Kingston, on the western side of the harbor. Plymouth harbor presents a vast area of flats more or less covered with eelgrass, with a great variety of soils. Three towns, Duxbury, Kingston and Plymouth, share the fishing rights of this harbor. The general and natural conditions are: (1) large rise and fall of tide; (2) good circulation of water, due to the swift currents, except on the shore flats of the western side; (3) high flats with long exposure; (4) variety of soils from a shifting sand to a soft mud; (5) great area of eelgrass flats.

Egobert's, the larger of the two Kingston flats, has an area of about 275 acres, covered by thick eelgrass except for a triangular piece on the mid-southern section, which comprises about 80 acres of smooth, unshifting sand. The greater part of this section is barren, although a few clams are scattered along the edge near the channel. Grey's flat, situated to the west of Egobert's, is of an entirely different type. It is a long flat, with a uniform width of 100 yards. It runs throughout its length parallel to the shore, while on the east side it is separated from Egobert's by a 300-foot channel. Like Egobert's, it is covered for the most part by eelgrass, but is essentially different in the nature of its soil which is mud throughout. Although the total area of the flat is about 115 acres, an irregular section of mud on the southeastern section, comprising 30 acres, is the only available clam territory. This area is composed of soft mud on the north and the south, but the middle section contains several acres of hard mud. Bed No. 118 was planted on the southwest side of Grey's, in the soft mud; the other two on Egobert's, — No. 187 in the eelgrass, No. 186 on the clear sand, with seed obtained at Marion.

The results, as will be seen by reference to the general table, were briefly as follows: on Egobert's the bed in the eelgrass showed a slower growth than the bed on the bare sand, due to difference in circulation of water. The averages for Grey's and Egobert's flats were about the same, showing that, where the current is the same, the soil, whether soft mud or hard sand, makes little difference in the growth of the quahaug. Growth between the tide lines, with a good circulation of water, even when the feeding period is limited to ten hours out of the twenty-four, is often better than in beds constantly under water, where there is less circulation of water. Culture on these flats is advisable only through the summer months, a gain of 2.4 bushels for every bushel of inch quahaugs planted being recorded for these two flats, as the planter runs the risk of losing his quahaugs in a severe winter. There are places where quahaugs could be safely bedded in deeper water in Plymouth harbor and Duxbury Bay, and there is reason to look forward to a combination of quahaug and clam culture on these flats. Along the western shore of the harbor the growth would be so slow as to render any culture on those shore flats impracticable, but in other parts of the harbor growth may be faster. As the growth is accomplished only during the summer months, the planter should buy large seed in the spring and sell the "little necks" in the fall, thereby not risking a winter loss.

Wellfleet Experiments.

The harbor of Wellfleet Bay, some 4 miles long and nearly 2 miles wide, contains approximately 2,500 acres of quahauging ground. The greater part of this territory is under water, ranging from a few feet in depth to upwards of 5 fathoms at low tide. Particularly in the

channel, where the water is deepest, quahaugs flourish in the greatest abundance. As the mean rise and fall of the tide is $10\frac{3}{4}$ feet, the currents flow with great swiftness, both on the ebb and flow of the tide. This may well be considered the natural home of the quahaug, as Wellfleet is the foremost town in the State in the production of this shellfish. Consequently, it seemed particularly fitting that this place should be made the scene of investigations of this nature.

The experiments were conducted during the summer of 1908, from the last of June till the first of December. All the beds in this harbor were planted between the tide lines. It was impossible to conduct experiments under water, as was done at Monomoy, owing to the fact that the tides and currents were so strong at Wellfleet as to make any raft experiments practically out of the question. Furthermore, the large fleet of quahaug boats which was engaged in the industry at this place constantly fished over the whole territory, and might have interfered with such experiments.

The beds were divided into two general divisions: (1) beds planted on staked areas in the sand or mud; (2) beds planted in boxes. The total number of the planted beds was 146, but only 84 were taken up. They were distributed along the coast from a point south of Smalley's bar on the west to a point south of Lieutenant's Island, near the Eastham line, on the east.

The size of these beds was small, usually not over 3 or 4 square feet. The main reason for this was the fact that the large territory to be studied necessitated the planting of a great number of beds, which could not, therefore, owing to our limited time, be of large size. Our custom was to drive a stake a foot long, more or less, firmly into the soil for about half its length at each corner of the bed. In addition we placed a sign beside the bed, describing the experiment as one conducted by the State. In the area enclosed by these stakes 50 quahaugs, averaging 25 millimeters in size, which had originally been obtained from the region known locally as Stony Bar, just south of Jeremy's Point, were planted by hand. These quahaugs were filed on the edge of the shell and accurately measured, so that the increase in length could be readily ascertained when they were taken up in the fall. When these beds were examined after an interval of several months the quahaugs were dug out of the sand with an ordinary clam hoe, their lengths measured, their new edges refiled, and on each the distance from the old to the new file marks accurately taken. This distance registered the increase in width, from which, by means of tables, we could easily compute the increase in length. They were then replanted in the same manner as at first, for comparison at some future date.

The 146 beds fall readily into ten divisions which are fairly well defined and easily separable. These divisions, beginning at the southwesternmost point in the harbor and extending around the circuit of the coast, are, taking them in order, as follows: (1) Smalley's bar,

(2) the Meadows, (3) Sow Rock bar, (4) Herring River, (5) Egg Island, (6) Indian Neck, (7) the north shore of Blackfish Creek, (8) the south shore of Blackfish Creek, (9) the west shore of Lieutenant's Island, (10) the south shore of Lieutenant's Island, and the neighboring region to the Eastham line.

Results.

General Growth. — The shell of the quahaug is taken as the standard in recording growth, as any increase in the soft parts causes a proportional enlargement of the shell. Of course, this does not take into account the quality of the meat, so important to the dealer, but no investigation along this line has been practicable at the present time.

The rate of growth of the quahaug is largely determined by its environment. While this accounts for much of the variation, it is true that individual differences do occur in the same bed under identical conditions, thus indicating that power of assimilation and growth varies with the individual. As a rule, the growth in any bed is fairly uniform, especially when large numbers are planted. The quahaug differs from the higher animals, in that its growth appears to be directly proportional to the amount of food consumed. Curiously enough its automatic feeding apparatus is constantly at work whenever the animal is taking water through its extended siphons, thus causing an almost constant feeding. The food consists of microscopic plant forms, called diatoms, which are distributed through the water. Naturally, the abundance of diatoms in any locality and the circulation of water are the two principal factors in growth.

Growth of the Young. — The growth of the young quahaug from the time of set or attachment was observed only at Monomoy Point, in the raft spat boxes. Here the small quahaugs were followed during the summers of 1906, 1907 and 1908, until the boxes were taken up in October and November. In 1908 the young quahaugs were visible to the naked eye as early as July 24, but in 1906 and 1907 they were not noticed until the second week in August. Contrary to expectations the small quahaugs in the spat boxes showed a slower growth than larger quahaugs under the same conditions. The average size of 276 quahaugs taken from these boxes by December 1 was only 4.9 millimeters, which seemed rather a slight five months' growth. The general average was probably lowered by the late set of certain quahaugs, since a few of the early set, when suspended from the raft in jars, showed an average gain of 3.4 millimeters per month, which would give a 9-millimeter quahaug on December 1. From these figures the arbitrary length of 5 millimeters has been adopted as the average size of the six-month quahaug on January 1.

The form of the young quahaug from the time of set is practically that of the adult. The only important difference is found in the prominent raised ridges, which readily enable the observer to distinguish

the young from other small mollusks of similar shape. On a 1-millimeter quahaug as many as 12 of these ridges could be counted (Fig. 28). As the quahaug grows these ridges appear at regular periods, evidently intervals of time rather than growth, and, as the animal grows older, gradually disappear.

Growth of Old and Young. — As can be seen from Table 2, the actual increase in length as well as the relative increase in volume constantly diminishes as the quahaug increases in size. In other words, the older and larger a quahaug becomes the more slowly it grows. By placing a series of quahaugs from 1 to 95 millimeters in boxes suspended from the raft under similar conditions as regards sand, depth and current, sufficient data were obtained to plot a curve of the year's growth and formulate a table for each sized quahaug from 1 to 100 millimeters. It was found from this experiment that a 14-millimeter quahaug evidenced the greatest gain in length, and that above this size the yearly growth for the larger quahaugs steadily diminished with advancing age. When a 14-millimeter quahaug showed a yearly gain of 27.7 millimeters, a 20-millimeter would give 25.2 millimeters; a 30-millimeter, 20.8 millimeters; a 40-millimeter, 17 millimeters; a 50-millimeter, 13.9 millimeters; a 60-millimeter, 11 millimeters; a 70-millimeter, 8.1 millimeters; an 80-millimeter, 5.1 millimeters; a 90-millimeter, 2.5 millimeters; a 100-millimeter, .6 millimeters. After the quahaug reaches a certain age or size the gain in thickness of the shell surpasses that of increasing length and width, with the result that the old quahaug becomes what is known by the fishermen as a blunt.

Blunts. — Quahaugs with shells thickened at the edges or lips, a sort of retrogressive growth typical of old age, are often taken from the fishing grounds. The size alone does not always indicate the age, as the conditions of its environment may be such as to cause a small-sized quahaug to become a blunt. In many respects slow growth is similar to old age, and may cause a thickening of the edges. Retrogressive growth occurs by a gain in thickness of the shell without a corresponding advance at the edge. Evidently the soft parts of the animal have attained their full development, and therefore the mantle cannot secrete new material for the extension of the shell.

Our experiments did not substantiate the statement of many quahaugers that blunt quahaugs, when placed in a favorable condition will become sharps, *i.e.,* attain once more a thin lip. Blunts of various thicknesses and sizes were obtained at Wellfleet and placed in the raft boxes at Monomoy Point, where conditions were favorable for rapid growth. Control experiments of small quahaugs were conducted at the same time. Part of the same lot of quahaugs were planted near the shore, where the conditions were less favorable for rapid growth. The experiments lasted from May 17 to Sept. 14, 1909. The results were briefly as follows: in the raft boxes, five classes were arbitrarily made, the first two irrespective of length and width, the last three of thickness

of lips. (1) Thick blunts; (2) thin blunts; (3) large blunts, 3¾ inches; (4) medium-sized, about 3 inches; (5) small, 2¾ inches.

(1) The thick blunts were divided between three boxes, containing, respectively, (*a*) broad blunts with ridge in center of edge; (*b*) square-edged blunts; (*c*) round-edged blunts. Box (*a*) showed an increase of 1.8 millimeters in width, as compared with a thickening of 3.22 millimeters, giving a ratio of 1.8 millimeters to 3.22 millimeters; box (*b*) 1.3 millimeters to 2.15 millimeters; and box (*c*) 1.5 millimeters to 2.35 millimeters, making an average ratio of 1.53 millimeters to 2.57 millimeters. None of the three boxes showed any definite indication of sharpening, although box (*b*) showed a thin raised edge of growth.

(2) The box of thin-lipped blunts showed a true blunting tendency, giving a typical rounded growth at the edge. These showed an increase in width of 1.6 millimeters, compared with a thickening of 4 millimeters.

(3) The large blunts were placed in three boxes, in classes of wide, medium and fine edges. The average of the three boxes gave a ratio of .7 millimeters to 2.55 millimeters, showing a slower growth for the large than the small and medium sized blunts. The large blunts with the thick lips showed the slowest gain.

(4) Two boxes of medium-sized blunts showed a ratio of 2.51 millimeters to 4.94 millimeters, one box showing a fairly good ring of growth, which might be considered an attempt at sharpening.

(5) The two boxes of small blunts showed a ratio of 1.7 millimeters to 3.6 millimeters, indicating that the shell thickened twice as fast as they increased in size.

The results in the shore experiments were as follows: the blunts placed under poor-growing conditions showed even slower growth, a gain of .22 millimeter in width, than on the raft boxes, and a correspondingly greater thickening. Also, the large blunts showed a slower growth than the small. Experiments were also tried in the opposite direction, *i.e.,* growing blunts from sharps. The sharps over 3 inches showed little gain and great thickening tendencies, but did not evidence any decided blunting. Twelve boxes were used on the raft and in the shore beds, the small sharps giving greater gain than the large.

Length of Life. — Owing to the impracticability of carrying on work for a sufficient period to determine the length of life of any particular set of quahaugs, any statements regarding the period of existence must necessarily be more or less of an estimate. Nevertheless, by means of Table 2 it is possible to give approximately close figures for the age of any given quahaug up to 4 inches in length. On the raft boxes at Monomoy Point, a very favorable place for growth, the following figures were obtained, starting with a 5-millimeter (⅕ inch) quahaug on January 1 at the age of six months. The size of 51.9 millimeters (slightly over 2 inches) was obtained in two and one-half years; 74.25 millimeters (slightly less than 3 inches) in four and one-

half years; 89.5 millimeters (slightly over 3½ inches) in seven and one-half years; 96 millimeters (slightly over 3¾ inches) in ten and one-half years; and 101.3 millimeters (about 4 inches) in sixteen and one-half years. The growth during the last six years is more or less a matter of conjecture, but up to the tenth year is approximately correct. In this case the quahaug was under favorable growing conditions. There are places where the growth is four times as slow as in the raft boxes, which would place the age of a large quahaug over fifty years. Where the growth was slow, the quahaugs would probably show blunting before they reached the size of 4 inches. Blunts are older than sharps, and their age is still more a matter of guess work, a decided blunt ranging from twenty-five years to an indefinite age.

The Little Neck. — The culturist who desires to raise the most profitable shellfish will inquire the length of time necessary for producing a marketable quahaug. The following answer, while general, will not apply in every case, since the rate of growth varies according to current, tide and other conditions of environment. In favorable surroundings the quahaug will reach a size of 2 inches in two and one-half years after birth, and at the same rate of growth will attain over 2½ inches in three and one-half years. In exceptionally favorable situations the size of 2¼ inches may be obtained in two and one-half years, and that of 2¾ inches in three and one-half years; but such rapid growth is seldom found, and more often is less than that indicated by the first set of figures. In one of the unfavorably situated experiments, where thick eelgrass cut off the circulation of water, it would have taken four times as long to produce the same size quahaug.

The Growing Months. — The quahaug, like the scallop (*Pecten irradians*), increases in size only during the summer months, no shell formation taking place during the cold weather. Its annual life consists of a period of active growth in the summer and a period of winter rest, during which the animal lies practically dormant. As with the scallop, growth begins about May 1, when the temperature of the water has reached 49° F., varying with the seasonal changes of the different years, and ceases during November, when the temperature has fallen below 45°. For all practical purposes growth ceases about November 1, at a temperature of 49°, which is especially true of the exposed Wellfleet flats, but at Monomoy Point there is a slight November growth. The decrease in the microscopic food forms (diatoms) in the water about December 1 is not sufficient to explain the cessation of growth, which is due rather to the inactivity or sluggishness of the quahaug during the cold weather. By monthly measurements of the quahaugs in the raft boxes and in the shore beds at Monomoy Point, the comparative value of the different summer months was determined in terms of the gain per cent. as follows: considering the entire year as 100 per cent., May received 3.78 per cent.; June, 10.81 per cent.;

July, 19.02 per cent.; August, 25.56 per cent.; September, 26.24 per cent.; October, 12.85 per cent., and November, 1.74 per cent.

Growth on Barren Flats. — There are few areas, no matter how adverse the natural conditions, where quahaugs will not live, but their rate of growth will depend entirely upon the environment. There are many barren flats on which they will grow, if planted, but on which certain conditions prevent the natural set. In the future it will be possible to utilize such areas for quahaug culture and to make productive localities now practically worthless.

Comparison of Localities. — The growth experiments were conducted chiefly at Wellfleet and Monomoy Point, a few beds being planted at Plymouth, Nantucket and Monument Beach. Adult quahaugs were planted for spawning purposes in the Essex and Ipswich rivers, but no record of their growth was taken. These quahaugs, one year after planting, were in a thriving condition, but showed no evidence of propagation. Nevertheless, under the prevailing conditions of rapid growth in these rivers, in spite of the inability to obtain a natural set, it should pay to plant quahaugs. The following table gives a comparison of the growth in the various localities. From a practical standpoint only the Monomoy and Wellfleet comparisons are of interest, as the other beds are too few in number.

	Nantucket.	Plymouth.	Monument Beach.	Wellfleet.		Monomoy.			
				Beds.	Boxes.	Raft Boxes.	Shore Boxes.	Shore Beds.	Flat Beds.
Number of beds,	1	3	1	80	4	48	32	6	3
Annual growth,	8.48	9.41	10.15	9.69	28.62	24.02	12.60	11.16	7.63
Increase in volume (per cent.),	132	149	163	155	783	574	216	183	117

The Monomoy experiments afforded a comparison for the four years 1906 to 1910 in the raft boxes and in the shore beds. On the raft the standard growth was as follows: in 1906, 22.84 millimeters; in 1907, 24.21 millimeters; in 1908, 18.72 millimeters; in 1909, 24.92 millimeters. In the shore beds the growth was 5.06 millimeters in 1906; 13.27 millimeters in 1907; 10.01 millimeters in 1908, and 17.43 millimeters in 1909. The slow growth for the shore beds in 1906 is partly due to the effects of transplanting, in 1908 to the closure of the outlet, which for several months interfered with the circulation in the Powder Hole.

A comparison of the various parts of the Powder Hole gives the following figures for the average growth: raft boxes, 24.02 millimeters; edge of clam flat near raft, 19.38 millimeters; clam flat, 7.63 millimeters; eastern part, 17.53 millimeters; east side, 8.92 millimeters; south side, 12.15 millimeters.

Natural Conditions.

There is no more convincing illustration of the influence of environment upon the life of the quahaug than the effect of the surrounding conditions upon its growth. Chief among these natural agents may be enumerated current, tide, soil, depth and salinity of the water, arranged in order of individual importance, yet so closely interwoven that their separate actions cannot always be clearly demonstrated. Their various combinations form a favorable or unfavorable environment for the growth of the quahaug, and govern largely the rapidity of its development. A discussion of these conditions involves their separate treatment, but the reader should realize that there are few, if any, instances where the pure uncomplicated action of a single natural condition can be obtained.

Current. — The most essential condition for shellfish growth is a good current, not necessarily an exceedingly swift flow, but rather a fair circulation of water. Current performs a threefold service: (1) it determines the supply of food for the body and lime for the shell; (2) it governs the supply of oxygen for the gills; and (3) finally, it acts as a sanitary agent.

(1) The food of the quahaug, as already stated, consists of microscopic forms, chiefly diatoms, in the water. The growth of the quahaug, as with lower animals, is directly proportional to the amount of food, and the animal situated in a current naturally receives a greater supply than one in still water. For all practical purposes current means food, and, within limits, increase in current indicates increase in the amount of food, thus furnishing an index of the growth. The amount consumed likewise depends upon the quantity in the water, the feeding power or capacity of the quahaug, and the absence of silt or other material in the water, which would interfere with the mechanical feeding process of the animal. In a similar way, current aids shell formation by increasing the supply of available lime salts.

(2) Intimately associated with its value as a food carrier is the no less important service of affording a good supply of oxygen. The quahaug, like man, needs a definite amount of oxygen to perform the normal functions of life, — to transform food into body tissues and energy. Current supplies fresh oxygen, and a quahaug with a good circulation of water is able to assimilate more food and grow faster than one in the still water.

(3) The work of sanitary agent is performed by carrying away all products of decomposition, thus preventing contamination in thickly planted beds.

From the standpoint of the culturist, circulation of water is most important, and in choosing a grant selection should be based upon the current. Nearly all our growth experiments, directly or indirectly, indi-

cate its value. A few cases are cited to show the direct experimental relation between current and growth.

A comparison of the growth in sand boxes at Monomoy Point was made in three parts of the Powder Hole: (*a*) the raft, which had a good circulation, gave an annual gain of 24.5 millimeters (612 per cent. gain in volume); (*b*) the south side, in front of the laboratory, where there was only a slight flow of water with the rise and fall of the tide, gave a gain of 16.18 millimeters (305 per cent. gain in volume); (*c*) the east side, where eelgrass cut off practically all circulation, showed a gain of 13.62 millimeters (241 per cent. gain in volume).

Wire mosquito netting was placed over part of the jars in which small quahaugs were suspended from the raft. A month later the quahaugs in the jars without netting showed a gain of 3.4 millimeters, compared with 1.21 millimeters for the netting jars, illustrating the effect on growth by restricting the circulation.

The channel connecting the Powder Hole and the ocean became blocked during the summer of 1908, with the result that there was a stagnation of water in the Powder Hole during part of the growing months. The shore beds showed a slow growth of 10.01 millimeters in 1908, as compared with 13.27 millimeters in 1907 and 17.43 millimeters in 1909.

In our experiments in Wellfleet Bay the greatest growth occurred in Herring River, Blackfish Creek and on Egg Island, which get both the backward and forward sweep of the tide. The various local groups of beds are here arranged in order of rapidity of growth: —

	Per Cent.		Per Cent.
Herring River, ...	100	West of Lieutenant's Island, .	52
Egg Island, ...	75	Blackfish Creek (north side), .	51
Blackfish Creek (south side), .	72	Sow Rock bar, ...	33
Indian Neck, ...	68	South of Lieutenant's Island, .	15
The Meadows, ...	55	East side of Great Island, .	9

Tide. — Quahaugs are found between the tide lines, but in less abundance than beneath low-water mark, their natural habitat. This circumstance may be the result of exposure to severe winters, since the quahaug lies near the surface of the soil and not at a depth, as the soft clam. The principal effect of exposure, as demonstrated by experimental beds between the tide lines at Plymouth and Wellfleet, is the retardation in growth from loss of feeding time. The quahaug can feed only when covered with water, and exposure from four to twelve hours daily materially lessens the amount of food consumed, assuming that the quahaug feeds continually when under water. Experiments have demonstrated that the longer the exposure, the slower the

growth. Eighty experimental beds between the tide lines at Wellfleet were classified as low, medium and high, according to the length of exposure (Fig. 36). The low beds, 32 in number, having a better circulation and longer feeding period, gave an annual growth of 12.5 millimeters (.49 of an inch); the 27 medium gave 7.82 millimeters (.31 of an inch); and the 21 high beds showed a gain of 7.17 millimeters (.28 of an inch). Considering the growth of the low beds as 100 per cent., the medium would show 61.53 per cent. and the high 57.39 per cent. While this evidence is open to the criticism that the faster growth of the low beds was due to a better circulation of water, it is confirmed by an experiment at Monomoy Point, where the annual growth was 24.02 millimeters in the raft boxes, as compared with 7.63 millimeters on the near-by clam flat under the same conditions, except for the exposure of the flat.

Planting between the tide lines entails considerable loss. Only 84 out of 154 beds were recovered at Wellfleet, over 50 of the remaining 70 having been washed away, buried or destroyed by cockles, the greatest loss occurring in the exposed portions of the bay, especially near Lieutenant's Island. After three months only 42 per cent. of the planted quahaugs were found in the 84 good beds. Life between the tide lines is a difficult existence for the quahaug, especially for the smaller animal, which is forced to maintain a continual struggle against adverse conditions.

Depth. — The depth of water over the grant is of practical interest to the culturist, who desires rapid growth and at the same time easy facilities for harvesting. Owing to the better circulation of water, the average growth in the deep water will exceed that in the shallow; but in localities where the current is approximately the same, any depth beyond 3 feet at low tide (for protection during the winter) gives no increased growth and affords a distinct disadvantage to the planter in taking up his crop. The quahaug appears to live equally well at any depth, and is occasionally raked in 50 feet of water on the north side of Cape Cod.

The relation of depth to growth could not be experimentally determined on a large scale owing to the cost and difficulty of planting in deep water. A few observations regarding the rate of growth at various depths were made from the raft at Monomoy Point, but these apply more to the study of circulating layers of water in the Powder Hole. In 1909, in 18 feet of water, boxes containing quahaugs of the same size were suspended from the raft at 5, 10 and 15 feet. The gain in these boxes in terms of the standard for four and one-half months was 536 per cent., 554 per cent. and 438 per cent., respectively. The maximum growth occurred between 5 and 10 feet, and is intimately associated with the circulation in the Powder Hole, only the upper layer of water, above 10 feet, being disturbed by the inflowing tide.

Soil. — The quahaug is found in nearly every kind of soil, — gravel, sand and mud all seem alike to this mollusk. It is found in hard soil, into which it is difficult to force a rake, and in soft mud, where the gatherer sinks ankle deep. The best soil, if such can be designated, is a mixture of sand and mud, sufficiently loose to permit easy raking. The important consideration is the effect of the various soils on the growth and condition of the quahaug, rather than whether the animal can live. Organic acids in certain soils affect the composition of the shell, and through their irritating influence retard the growth by increasing the repairing processes. The kind of soil also affects the composition and shape of the shell, coarse, gravelly soil, especially in the case of the soft clam, giving a heavy, rough shell, in contrast to the thin paper-shell variety of the fine sand clam. In one instance quahaugs on a soft mud bottom had developed an elongate shell. In general, the soil has little influence upon the growth of the quahaug, and acts only as a resting place. The popular idea that the quahaug procures its nourishment from the soil, like a vegetable, is entirely erroneous, as the animal obtains its food from the water. The nature of the soil indirectly modifies the food supply, as certain soils are more prolific breeding grounds of the microscopic forms which make up the food of the quahaug.

(1) *Growth in Wire Cages.* — Kellogg (2) first described the growth of quahaugs in wire racks out of sand. Our experiments along this line were made with the view of developing a method of keeping quahaugs for the market without bedding in the sand. Wire cages, 1½ by 1 by ¼ feet, of ¼ to 1¼ inch mesh, were suspended in 1906 and 1907 from the raft at Monomoy Point. The annual growth was 12.87 millimeters, as compared with 23.53 millimeters for quahaugs in the sand boxes under the same conditions. A greater difference was found in 1909 with larger quahaugs (69 millimeters), which showed one-fourth the gain of the quahaugs in the sand boxes. The slower growth in the wire cages was due to the unnatural environment, which interfered with the natural feeding habits, and to the encrusting of the shells with barnacles, Serpula, Anomia, Crepidula and oysters, which use the same food. The experiment demonstrates that soil has little effect on shell formation, the quahaug obtaining its food and mineral salts from the water; and that quahaug culture in wire cages is impracticable, because it yields poor returns and is an expensive method of holding the catch for market.

(2) *Mud v. Sand.* — A comparison of the growth in mud and sand under similar conditions was made at Monomoy Point by suspending quahaugs of the same size from the raft in two boxes, one containing a sticky, black mud, the other clean, coarse sand. The increase in volume for the mud was 342 per cent. and 424 per cent. for the sand, which shows that the actual type of soil is of little consequence.

(3) *Eelgrass.* — The soil exerts an indirect influence on growth by the abundance or scarcity of eelgrass, which if thick prevents the free circulation of water over the bed. In addition to the examples cited under "Current," a comparison of experiments Nos. 186 and 187 on Egobert's Flat, Plymouth harbor, gives an annual growth of 11.73 millimeters for the clear and 7.43 millimeters for the eelgrass, although both beds were near together. The presence of eelgrass is not necessarily an indication of slow growth, as it only becomes a detriment when thick enough to interfere with the circulation.

Salinity. — The amount of salts in solution, although it may influence the spawning, does not materially affect the growth of the quahaug. Experimental beds, located in densities from 1.009 (less than one-half the ordinary salt content) to 1.026 (fairly high salt content), have shown no appreciable effects. In the laboratory, quahaugs have been kept alive in tanks in which the water, by evaporation, reached a salinity of 1.035. They have also been found in rivers with a daily variation in density from 1.015 to 1.022. Salinity, however, indirectly affects growth by modifying the food supply, brackish waters being more productive of diatoms.

Dwarf Quahaugs. — Quahaugs, like the higher animals, vary in their individual growth. Occasionally a specimen exhibits a consistently slow growth, either from an unfavorable position or from impaired feeding power. In case of defective nutrition shell formation will be slow for a number of years, and even for life. In one experimental bed a dwarf quahaug showed an annual growth of 6 millimeters, compared with an average of 9.35 millimeters in 1907; 4 millimeters, with 8.33 millimeters in 1908; and 5 millimeters, with 7.83 millimeters in 1909, which was less than two-thirds its normal growth.

Growth under Adverse Conditions. — In localities where conditions are at all unfavorable, 30 to 40 millimeter quahaugs grow more rapidly than smaller sizes, in direct contrast to growth under favorable conditions, where the 15-millimeter quahaug exhibits the greatest growing power. In the shore beds at Monomoy Point, where the environment proved a hindrance to rapid growth, 1,700 measurements gave a gain of 3.93 millimeters for quahaugs between 24 and 30 millimeters, compared with 4.93 millimeters for quahaugs between 30 and 40 millimeters. This difference is best explained by the ability of the larger quahaugs to combat the adverse conditions.

Growth in Thickly Planted Beds. — Nature regulates thick sets of clams or quahaugs by the simple process of gradually forcing out the superfluous shellfish, and leaving only the maximum number per square foot that the soil will support. If the bed has a poor circulation of water an overpopulation may cause an insufficient food supply and slower growth than if less thickly planted. The number per square foot which will give the best growth in any locality can be determined

only by experiment, the planter gradually increasing his stock until the maximum production is reached. In the boxes at Monomoy Point various numbers of $1\frac{1}{2}$-inch quahaugs, from 7 to 90 per square foot, gave uniform results. The box containing 90 to the square foot, which was so crowded that several were forced out of the sand, showed about two-thirds the growth of the others. This experiment only illustrates the effect of crowding, and has no practical bearing on the maximum production of a large grant, which is entirely a question of the food supply.

Transplanting. — Transplanted quahaugs do not at first exhibit their usual rate of growth, as they take some time to become accustomed to their new environment. In planting between the tide lines at Wellfleet, where the quahaugs are exposed to the action of the waves and shifting sand, a sufficient time, about one month, is necessary for the regulation of the feeding habits. This fact should be borne in mind in determining the growth for any locality, as described under "Tables," and no less than two months be taken for the test. It is an advantage to plant in April, which affords an opportunity for the quahaugs to become accustomed to their surroundings before growth begins, May 1. The period of acclimatization is an extremely variable factor, depending on the size of the quahaugs, the date of planting (the period being longer in the fall), length of time out of water, and the change in environment. The decrease in growth from a complete change in environment and late planting is shown in the wire cages in 1906 and 1907. The quahaugs were placed in their new surroundings Sept. 18, 1906. The calculated rate of growth for 1906, 6.41 millimeters, was only one-half that of 1907, 12.87 millimeters, owing to the subnormal growth during September and October. Similarly, quahaugs transplanted from Nantucket to the raft boxes at Monomoy Point gave a calculated rate of 16.58 millimeters for 1906, as compared with 23.13 millimeters for 1907.

Growth in Boxes.— From a comparison of sand boxes and beds under the same condition it was found that growth was invariably faster in the boxes. The same results had been recorded in clam experiments on the Plymouth flats, where faster growth was obtained in boarded beds raised above the flat. Near Egg Island, Wellfleet, 3 box beds averaged an annual gain of 29.12 millimeters, compared with 12.06 millimeters for 13 ordinary beds. The idea that drainage was the cause was disproved by similar results being obtained below low-water mark at Monomoy Point. Boxes with sides of different heights were tried, to determine if these in some way aided the feeding, and boxes large and small, without sides, with and without bottoms, were used, but no appreciable difference was found; yet in every case growth was faster in the boxes than in the control beds. Also, the distance from the bottom, as demonstrated by a series of boxes arranged in the

form of steps, made no difference. An explanation, which in part accounted for this curious result, arose from the situation of these beds. In all cases the beds at certain times were exposed to wave action, which caused a slight shifting of sand, presumably enough to interfere with the feeding. The quahaugs in the boxes were protected from this action and were given better opportunity for feeding.

TABLES.

The following tables, which were formulated during the investigation, are presented for the use of the quahaug culturist in determining the productivity of new ground. The last, Table V, gives the summarized results from 187 experimental beds.

The method of procedure in determining the growth on a prospective grant for a series of years by means of these tables is as follows: —

(1) The culturist must obtain the growth for a definite period of not less than two months by planting a small experimental bed with quahaugs of a known size. The simplest way is to notch the edges with a file and the new growth can readily be measured when the quahaugs are taken up. The reasons for having the growing period no less than two summer months is due to the slow growth immediately after transplanting, as described under "Transplanting." The planter then has at hand the following data: (1) size planted; (2) gain in length for a certain known time, *i.e.*, 40-millimeter quahaugs grew to 48.92 millimeters, a gain of 8.92 millimeters from July 1 to September 1.

(2) By means of Table I. (monthly values) we find that the growth during July and August is 44.58 per cent. of the total yearly growth, which is therefore 20 millimeters.

(3) Table II. reduces the gain of a 40-millimeter quahaug to that of a 25-millimeter, which is used as a uniform standard in the experiments of this department, by multiplying with the factor 1.353, and in this example the result will be 27.06 millimeters.

(4) By Table III. the gain in volume is obtained by dividing the water displacement or number per quart of a 52.06-millimeter quahaug by that of a 25-millimeter, which gives 709 per cent., or 8 quarts for every quart planted.

(5) By Table IV. the growth on the grant can be calculated to five and one-half years. In the case of a gain of 20 millimeters for a 25-millimeter quahaug, the figures would read ½ year 5 millimeters; 1½, 28.30 millimeters; 2½, 46.98 millimeters; 3½, 59.85 millimeters; 4½, 69.46 millimeters; 5½, 76.64 millimeters (25.4 millimeters equal 1 inch).

Value of the Different Months. — The quahaug only increases the size of the shell during the summer months, and at a variable rate, the months of August and September showing the fastest growth. The table

is taken from the monthly measurements of quahaugs from the raft boxes and beds at Monomoy Point, and the value of the various months is presented in terms of the gain for a standard quahaug of 25 millimeters. Each month is given a number representing the gain in per cent., the entire year being considered as 100 per cent.

Table I.

Month.	Per Cent.	Month.	Per Cent.
January,	–	August,	25.56
February,	–	September,	26.24
March,	–	October,	12.85
April,	–	November,	1.74
May,	3.78	December,	–
June,	10.81		100.00
July,	19.02		

Size and Growth. — In recording the growth of a large number of various sized quahaugs under the same conditions in the raft boxes at Monomoy Point sufficient data were obtained to formulate a table giving the comparative annual increase in length for quahaugs from 1 to 100 millimeters in size. If, for example, a 25-millimeter quahaug, which is taken as a standard size in our experiments, gained 23 millimeters, a 50-millimeter quahaug would gain 13.9 millimeters, and a 75-millimeter quahaug 6.6 millimeters in the same time. From these measurements factors were obtained which by multiplication would transform the growth of any sized quahaug into terms of the standard 25-millimeter quahaug. This table was of great assistance in reducing the experimental data to uniform figures when it was impossible to obtain the standard size for planting.

According to the table the size of 14 millimeters gives the best growth, all larger sizes gradually decreasing. Theoretically, as shown in the table, the sizes below 14 millimeters reversely exhibit slower growth, but practically this is somewhat offset by the increase in velocity, as the quahaug grows toward 14 millimeters in size, *i.e.,* a 5-millimeter quahaug practically would gain 26.80 millimeters, although theoretically its initial growing power would only be 20.02 millimeters at the same rate according to the table.

Table II.

Size in Millimeters.	Factor.	Size in Millimeters.	Factor.	Size in Millimeters.	Factor.
1, ...	2.875	35, ...	1.223	69, ...	2.738
2, ...	1.840	36, ...	1.243	70, ...	2.840
3, ...	1.474	37, ...	1.271	71, ...	2.949
4, ...	1.278	38, ...	1.299	72, ...	3.067
5, ...	1.139	39, ...	1.329	73, ...	3.194
6, ...	1.046	40, ...	1.353	74, ...	3.333
7, ...	.979	41, ...	1.377	75, ...	3.485
8, ...	.931	42, ...	1.411	76, ...	3.651
9, ...	.895	43, ...	1.438	77, ...	3.833
10, ...	.868	44, ...	1.465	78, ...	4.035
11, ...	.849	45, ...	1.494	79, ...	4.259
12, ...	.836	46, ...	1.523	80, ...	4.510
13, ...	.830	47, ...	1.554	81, ...	4.792
14, ...	.830	48, ...	1.586	82, ...	5.055
15, ...	.833	49, ...	1.620	83, ...	5.349
16, ...	.849	50, ...	1.655	84, ...	5.679
17, ...	.865	51, ...	1.691	85, ...	6.053
18, ...	.881	52, ...	1.729	86, ...	6.479
19, ...	.895	53, ...	1.769	87, ...	6.970
20, ...	.913	54, ...	1.804	88, ...	7.541
21, ...	.927	55, ...	1.840	89, ...	8.215
22, ...	.947	56, ...	1.886	90, ...	9.200
23, ...	.962	57, ...	1.933	91, ...	10.000
24, ...	.979	58, ...	1.983	92, ...	10.952
25, ...	1.000	59, ...	2.035	93, ...	12.105
26, ...	1.022	60, ...	2.091	94, ...	13.143
27, ...	1.046	61, ...	2.140	95, ...	14.839
28, ...	1.065	62, ...	2.191	96, ...	16.788
29, ...	1.085	63, ...	2.289	97, ...	17.500
30, ...	1.106	64, ...	2.347	98, ...	23.000
31, ...	1.127	65, ...	2.421	99, ...	28.750
32, ...	1.150	66, ...	2.500	100, ...	38.333
33, ...	1.174	67, ...	2.570		
34, ...	1.198	68, ...	2.644		

Size and Volume. — The mere statement of the gain in length does not adequately express the actual increase, which should be stated in terms of volume. The tight shell of the quahaug makes easy the exact determination of the volume by water displacement. A quahaug 25 millimeters (about 1 inch in length) displaces 3 cubic centimeters of water, while 51 millimeters (about 2 inches in length) is not merely twice as large, as the measurements indicate, but, displacing 22.8 cubic centimeters, has a volume of 7.6 times the first, a true index of the actual increase. In preparing the following table the water displacements of a large number of quahaugs from 1 to 88 millimeters were taken. Owing to the variation in the individual quahaugs, several hundred were used to obtain the displacement for each size, except in the cases of the quahaugs below 10 millimeters, which were difficult to obtain. From this table the gain in volume for any size and growth can be readily determined.

Table III.

Size in Millimeters.	Volume in Cubic Centimeters.	Number per Quart.	Size in Millimeters.	Volume in Cubic Centimeters.	Number per Quart.
1, ...	.007	100,714	25, ...	3.000	235
2, ...	.013	54,231	26, ...	3.400	207
3, ...	.021	33,572	27, ...	3.820	185
4, ...	.032	22,031	28, ...	4.250	166
5, ...	.043	16,396	29, ...	4.700	150
6, ...	.056	12,589	30, ...	5.170	136
7, ...	.072	9,790	31, ...	5.670	124
8, ...	.091	7,747	32, ...	6.180	114
9, ...	.133	5,299	33, ...	6.700	105
10, ...	.191	3,691	34, ...	7.250	97.25
11, ...	.255	2,764	35, ...	7.800	90.35
12, ...	.313	2,252	36, ...	8.400	83.92
13, ...	.393	1,794	37, ...	9.050	77.90
14, ...	.490	1,439	38, ...	9.750	72.31
15, ...	.600	1,175	39, ...	10.500	67.14
16, ...	.718	982	40, ...	11.300	62.39
17, ...	.848	831	41, ...	12.000	58.75
18, ...	.998	706	42, ...	12.900	54.65
19, ...	1.210	583	43, ...	13.800	51.09
20, ...	1.440	489	44, ...	14.800	47.63
21, ...	1.680	420	45, ...	15.800	44.64
22, ...	1.970	358	46, ...	16.900	41.72
23, ...	2.270	310	47, ...	18.000	39.17
24, ...	2.600	271	48, ...	19.000	37.11

Table III. — Concluded.

Size in Millimeters.	Volume in Cubic Centimeters.	Number per Quart.	Size in Millimeters.	Volume in Cubic Centimeters.	Number per Quart.
49, ...	20.200	34.90	69, ...	55.200	12.77
50, ...	21.500	32.79	70, ...	57.700	12.22
51, ...	22.800	30.92	71, ...	60.100	11.73
52, ...	24.200	29.13	72, ...	63.000	11.19
53, ...	25.600	27.54	73, ...	65.700	10.73
54, ...	26.900	26.21	74, ...	68.400	10.31
55, ...	28.300	24.91	75, ...	71.100	9.92
56, ...	29.800	23.66	76, ...	74.200	9.50
57, ...	31.300	22.53	77, ...	77.300	9.12
58, ...	33.000	21.36	78, ...	80.400	8.77
59, ...	34.600	20.38	79, ...	83.900	8.40
60, ...	36.300	19.42	80, ...	87.300	8.08
61, ...	38.200	18.46	81, ...	90.900	7.76
62, ...	40.300	17.49	82, ...	95.000	7.42
63, ...	42.400	16.63	83, ...	99.500	7.09
64, ...	44.500	15.84	84, ...	104.200	6.77
65, ...	46.600	15.13	85, ...	109.000	6.47
66, ...	48.700	14.48	86, ...	114.000	6.18
67, ...	50.900	13.85	87, ...	118.700	5.94
68, ...	53.000	13.30	88, ...	123.000	5.73

Standard Growth. — The growth in millimeters up to five and one-half years is given for various annual rates of growth, from 1 to 30 millimeters, of a standard 25-millimeter quahaug. Knowing the annual growth for a 25-millimeter quahaug, the reader can determine the size at any period up to five and one-half years by referring to the other columns.

Table IV.

Annual Rates in Millimeters for a 25-Millimeter Quahaug.	Size in Millimeters at Various Ages.					
	½ Year.	1½ Years.	2½ Years.	3½ Years.	4½ Years.	5½ Years.
1, ...	5	5.89	6.84	7.85	8.92	10.03
2, ...	5	6.93	9.01	11.29	13.67	16.08
3, ...	5	8.13	11.49	15.08	18.68	22.05
4, ...	5	9.19	13.68	18.50	23.00	27.16

Table IV. — Concluded.

Annual Rates in Millimeters for a 25-Millimeter Quahaug.	Size in Millimeters at Various Ages.					
	½ Year.	1½ Years.	2½ Years.	3½ Years.	4½ Years.	5½ Years.
5,	5	10.39	16.34	22.21	27.47	32.21
6,	5	11.63	18.86	25.57	31.50	36.78
7,	5	12.90	21.33	28.78	35.26	40.96
8,	5	14.19	23.83	32.03	38.98	45.00
9,	5	15.48	26.19	34.96	42.32	48.66
10,	5	16.65	28.29	37.63	45.39	52.03
11,	5	17.82	30.35	40.23	48.32	55.20
12,	5	18.98	32.39	42.74	51.13	58.20
13,	5	20.14	34.35	45.11	53.80	61.03
14,	5	21.31	36.31	47.49	56.41	63.75
15,	5	22.48	38.19	49.68	58.80	66.21
16,	5	23.64	40.08	51.88	61.17	68.62
17,	5	24.81	41.88	54.07	63.47	70.81
18,	5	25.97	43.59	55.97	65.52	72.83
19,	5	27.14	45.27	57.92	67.52	74.80
20,	5	28.30	46.98	59.85	69.46	76.64
21,	5	29.47	48.65	61.76	71.40	78.41
22,	5	30.64	50.29	63.50	72.99	79.88
23,	5	31.80	51.88	65.22	74.44	81.21
24,	5	32.97	53.43	66.81	76.20	82.71
25,	5	34.13	54.94	68.54	77.81	84.07
26,	5	35.30	56.45	70.08	79.22	85.25
27,	5	36.46	57.95	71.58	80.52	86.31
28,	5	37.63	59.36	72.98	81.75	87.36
29,	5	38.79	60.72	74.36	82.92	88.40
30,	5	39.96	62.15	75.75	84.06	89.32

The Experimental Beds. — This table gives a summary of the experiments of this department. The current is represented by numbers from 1 to 5, according to its velocity, 1 indicating still water and 5 a rapid flow. The average annual growth and increase in volume is given in terms of a 25-millimeter quahaug, which has been taken as an arbitrary standard for the sake of comparison. The size, in terms of the length, at various ages is given in yearly intervals from one-half to five and one-half years, starting with the average length of 5 millimeters.

Table V.

No. of Experiment.	Location.	Current.	Soil.	Depth of Water in Feet at Low Tide.	Salinity.	Annual Growth in Millimeters.	Gain Per Cent. in Volume.	Size in Millimeters at Various Ages.						Remarks.
								½ Yr.	1½ Yrs.	2½ Yrs.	3½ Yrs.	4½ Yrs.	5½ Yrs.	
1	Nantucket, Polyps harbor,	2	Compact mud, .	.3	1.009	8.48	132	5	14.81	24.96	33.44	40.58	46.76	
2	Monument Beach, . .	2	Mud, . .	2.0	1.022	10.15	163	5	16.83	28.75	38.15	45.93	52.59	
3	Monomoy, east side of Powder Hole.	1	Coarse sand, .	2.5	1.022	8.91	140	5	15.36	25.98	34.70	42.02	48.33	Bed near shore.
4	Monomoy, south side of Powder Hole.	2	Coarse sand, .	2.5	1.022	10.27	165	5	16.97	28.85	38.33	46.18	52.89	Bed near shore.
5	Monomoy, south side of Powder Hole.	2	Coarse sand, .	2.5	1.022	13.37	234	5	20.57	35.08	45.99	54.77	61.94	Bed near shore.
6	Monomoy, south side of Powder Hole.	2	Coarse sand, .	2.5	1.022	12.81	221	5	19.92	33.98	44.66	53.29	60.49	Bed near shore.
7	Monomoy, south side of Powder Hole.	2	Coarse sand, .	2.0	1.022	12.09	204	5	19.08	32.57	42.95	51.37	58.46	Bed near shore.
8	Monomoy, east side of Powder Hole.	2	Coarse sand, .	2.0	1.022	9.53	151	5	16.10	27.30	36.38	43.95	50.45	Bed near shore.
9	Monomoy, flat, . . .	2	Coarse sand, .	Exposed.	1.024	4.78	69	5	10.13	15.75	21.39	26.49	31.10	Shifting sand.
10	Monomoy, raft, . . .	4	Coarse sand, .	5.0	1.024	18.87	389	5	26.99	45.05	57.67	67.36	74.54	Sand box.
11	Monomoy, raft, . . .	4	Coarse sand, .	4.5	1.024	23.07	536	5	31.88	51.99	65.33	74.56	81.32	Sand box.
12	Monomoy, raft, . . .	4	Coarse sand, .	6.5	1.024	22.30	510	5	30.98	50.77	64.02	73.43	80.28	Sand box.
13	Monomoy, raft, . . .	4	Coarse sand, .	5.5	1.024	27.58	734	5	37.14	58.77	72.39	81.23	86.92	Sand box.
14	Monomoy, raft, . . .	4	Coarse sand, .	5.5	1.024	25.50	638	5	34.72	55.70	69.31	78.52	84.66	Sand box.
15	Monomoy, raft, . . .	4	Coarse sand, .	5.5	1.024	21.68	488	5	30.27	49.77	62.94	72.48	79.41	Sand box.
16	Monomoy, raft, . . .	4	Coarse sand, .	4.0	1.024	21.40	478	5	29.93	49.31	62.46	72.04	79.00	Sand box.
17	Monomoy, raft, . . .	4	Coarse sand, .	4.5	1.024	25.12	622	5	34.27	55.12	68.72	77.98	84.21	Sand box.
18	Monomoy, raft, . . .	4	Coarse sand, .	5.0	1.024	24.73	605	5	33.82	54.53	68.07	77.38	83.70	Sand box.

19	Monomoy, raft, . . .	4	Coarse sand, .	3.5	1.024	25.00	617	5	34.13	54.94	68.54	77.81	84.07	Sand box.
20	Monomoy, raft, . . .	4	Coarse sand, .	5 0	1.024	20.37	440	5	28.73	47.60	60.56	70.18	77.29	Sand box.
21	Monomoy, raft, . . .	4	Coarse sand, .	4.5	1.024	25.08	620	5	34.22	55.06	68 66	77.92	84.16	Sand box.
22	Monomoy, middle of Powder Hole.	3	Coarse sand, .	11 0	1.024	13.98	250	5	21.29	36.27	47.45	56.36	63.70	Sand box.
23	Monomoy, raft, . . .	4	Coarse sand, .	4.0	1.024	26.09	664	5	35.40	56.59	70.22	79.34	85.35	Sand box.
24	Monomoy, south side of Powder Hole.	2	Coarse sand, .	.5	1.022	17.42	343	5	25.30	42.60	54.87	64.33	71.66	Sand box.
25	Monomoy, south side of Powder Hole.	2	Coarse sand, .	.5	1.022	14.26	257	5	21.61	36.80	48.06	57.05	64.40	Sand box.
26	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.11	621	5	34.26	55.11	68.71	77.97	84.20	Sand box.
27	Monomoy, raft, . .	4	Coarse sand, .	9.0	1.024	21.81	493	5	30.42	49.98	63.17	72.68	79.60	Sand box.
28	Monomoy, raft, . .	4	Coarse sand, .	8.0	1.024	21.23	472	5	29.74	49.03	62.16	71.77	78.75	Sand box.
29	Monomoy, raft, . .	4	Coarse sand, .	11.0	1.024	24.31	587	5	33.33	53.90	67.35	76.70	83.13	Sand box.
30	Monomoy, raft, . .	4	Coarse sand, .	3.0	1.024	24.18	581	5	33.18	53.70	67.12	76.49	82.95	Sand box.
31	Monomoy, raft, . .	4	Coarse sand, .	8.0	1.024	24.66	602	5	33.74	54.43	67.95	77.26	83.61	Sand box.
32	Monomoy, middle of Powder Hole.	3	Coarse sand, .	11.0	1.024	14.78	271	5	22.21	37.77	49.19	58.27	65.70	Sand box.
33	Monomoy, raft, . .	4	Coarse sand, .	7.0	1.024	21.91	497	5	30.53	50.14	63.34	72.85	79.75	Sand box.
34	Monomoy, raft, . .	4	Coarse sand, .	3.5	1.024	21.41	478	5	29.95	49.32	62.47	72.05	79.01	Sand box.
35	Monomoy, edge of clam flat,	4	Coarse sand, .	1.0	1.024	19.76	419	5	28.02	46.57	59.39	68.99	76.20	Sand box.
36	Monomoy, raft, . .	4	Coarse sand, .	2.0	1.024	14.13	253	5	21.46	36.55	47.82	56.74	64.07	Sand box, planted late in the season.
37a	Monomoy, south side of Powder Hole.	2	Coarse sand, .	.8	1.022	7.51	115	5	13.55	22.61	30.44	37.16	43.02	Sand box.
37b	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	9.22	145	5	15.86	26.86	35.81	43.30	49.74	Sand box.
37c	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.3	1.022	1.14	15	5	6.04	7.14	8.33	9.59	10.88	
38a	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	7.31	111	5	13.30	22.11	29.79	36.41	42.21	Sand box.

Table V. — Continued.

No. of Experiment.	Location.	Current.	Soil.	Depth of Water in Feet at Low Tide.	Salinity.	Annual Growth in Millimeters.	Gain Per Cent. in Volume.	Size in Millimeters at Various Ages.						Remarks.
								½ Yr.	1½ Yrs.	2½ Yrs.	3½ Yrs.	4½ Yrs.	5½ Yrs.	
38b	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	6.58	99	5	12.37	20.29	27.43	33.68	39.20	Sand box.
38c	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	7.80	120	5	13.93	23.33	31.38	38.24	44.19	Sand box.
38d	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	7.20	109	5	13.16	21.83	29.43	36.00	41.77	Sand box.
39a	Monomoy, raft,	4	Coarse sand,	7.0	1.024	11.03	181	5	17.85	30.41	40.31	48.41	55.29	Sand box, covered.
39b	Monomoy, raft,	4	Coarse sand,	7.0	1.024	13.16	229	5	20.32	34.67	45.49	54.22	61.47	Sand box, uncovered.
40a	Monomoy, raft,	4	Coarse sand,	6.0	1.024	22.07	502	5	30.72	50.40	63.62	73.09	79.97	Sand box, 90 quahaugs per square foot.
40b	Monomoy, raft,	4	Coarse sand,	6.0	1.024	23.44	551	5	32.31	52.56	65.93	75.21	81.87	Sand box, 60 quahaugs per square foot.
40c	Monomoy, raft,	4	Coarse sand,	6.0	1.024	25.01	617	5	34.14	54.96	68.56	77.82	84.08	Sand box, 45 quahaugs per square foot.
40d	Monomoy, raft,	4	Coarse sand,	6.0	1.024	25.16	624	5	34.32	55.16	68.79	78.04	84.26	Sand box, 22 quahaugs per square foot.
40e	Monomoy, raft,	4	Coarse sand,	6.0	1.024	21.10	467	5	29.59	48.81	61.93	71.56	78.56	Sand box, 7 quahaugs per square foot.
41a	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	7.73	119	5	13.84	23.15	31.15	37.98	43.91	Sand box, 60 quahaugs per square foot.
41b	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	10.08	162	5	16.74	28.45	37.83	45.62	52.28	Sand box, 45 quahaugs per square foot.
41c	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	8.38	130	5	14.68	24.73	33.14	40.25	46.39	Sand box, 22 quahaugs per square foot.
41d	Monomoy, south side of Powder Hole.	2	Coarse sand,	1.0	1.022	6.08	90	5	11.73	19.06	25.83	31.80	37.11	Sand box, 7 quahaugs per square foot.
42	Monomoy, clam flat,	4	Coarse sand,	Exposed.	1.024	11.71	19	5	18.64	31.80	42.01	50.32	57.33	
43	Monomoy, clam flat,	4	Coarse sand,	Exposed.	1.024	6.39	96	5	12.13	19.82	26.82	32.97	38.41	
44	Monomoy, edge of clam flat,	4	Coarse sand,	1.0	1.024	21.28	474	5	29.80	49.11	62.24	71.85	78.82	Sand box.
45	Monomoy, raft,	4	Coarse sand,	5.0	1.024	23.45	551	5	32.33	52.58	66.04	75.23	81.89	Sand box.

46	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	9.10	143	5	15.50	26.40	35.23	42.63	49.00	Wire cage.
47	Monomoy, raft, . .	4	Coarse sand, .	6.5	1.024	10.74	175	5	17.52	29.81	39.55	47.56	54.38	Wire cage.
48	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	8.29	129	5	14.56	24.51	32.88	39.95	46.06	Wire cage.
49	Monomoy, south side of Powder Hole.	2	Coarse sand, .	.3	1.022	12.47	213	5	19.53	33.31	43.85	52.38	59.53	Sand box.
50a	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	21.57	484	5	30.14	49.58	62.75	72.31	79.25	Sand box.
50b	Monomoy, east side of Powder Hole.	1	Coarse sand, .	2.0	1.022	9.87	158	5	16.50	28.02	37.28	44.99	51.59	Sand box.
50c	Monomoy, east side of Powder Hole.	1	Coarse sand, .	2.5	1.022	8.91	140	5	15.36	25.98	34.70	42.02	48.33	
51	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	19.13	397	5	27.29	45.96	58.52	68.05	75.82	Sand box.
52	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	21.16	469	5	29.66	48.91	62.04	71.65	78.65	Sand box.
53	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	19.91	424	5	28.20	46.83	59.68	69.29	76.47	Sand box.
54	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.0	1.022	17.91	357	5	25.87	43.44	55.80	65.34	72.65	Sand box.
55	Monomoy, south side of Powder Hole.	2	Coarse sand, .	2.0	1.022	18.42	374	5	26.46	44.30	56.79	66.36	73.66	
56	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1 5	1.022	17.11	333	5	24.94	42.07	54.28	63.60	71.03	Sand box.
57	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.5	1.022	16.55	317	5	24.18	41.07	53.08	62.44	69.82	Sand box.
58	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.5	1.022	16.25	308	5	23.93	40.53	52.43	61.75	69.17	Sand box.
59	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.5	1.022	19.03	394	5	27.17	45.32	57.98	67.58	74.85	Sand box.
60	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.5	1.022	15.56	290	5	23.13	39.25	50.91	60.13	67.56	Sand box.
61	Monomoy, south side of Powder Hole.	2	Coarse sand, .	1.5	1.022	13.45	236	5	20.67	35.25	46.18	54.97	62.25	Sand box.
62	Monomoy, east side of Powder Hole.	1	Coarse sand, .	1.5	1.022	14.07	252	5	21.39	36.44	47.64	56.58	63.92	Sand box.
63	Monomoy, east side of Powder Hole.	1	Coarse sand, .	1.5	1.022	13.23	231	5	20.41	34.81	45.66	54.40	61.65	Sand box.
64	Monomoy, east side of Powder Hole.	1	Coarse sand, .	1.5	1.022	14.85	273	5	22.30	37.91	49.35	58.44	65.84	Sand box.
65	Monomoy, east side of Powder Hole.	1	Coarse sand, .	1.5	1.022	12.11	204	5	19.11	32.62	43.00	51.42	58.51	Sand box.

Table V. — Continued.

No. of Experiment.	Location.	Current.	Soil.	Depth of Water in Feet at Low Tide.	Salinity.	Annual Growth in Millimeters.	Gain Per Cent. in Volume.	Size in Millimeters at Various Ages.						Remarks.
								½ Yr.	1½ Yrs.	2½ Yrs.	3½ Yrs.	4½ Yrs.	5½ Yrs.	
66	Monomoy, east side of Powder Hole.	1	Coarse sand, .	1.5	1.022	12.63	216	5	19.71	33.62	44.23	52.81	59.98	Sand box.
67	Monomoy, edge of clam flat,	4	Coarse sand, .	1.5	1.024	10.95	179	5	17.76	30.25	40.10	48.17	55.04	Sand box.
68	Monomoy, edge of clam flat,	4	Coarse sand, .	1.5	1.024	8.83	139	5	15.26	25.79	34.46	41.75	48.04	Sand box.
69	Monomoy, edge of clam flat,	4	Coarse sand, .	1.5	1.024	11.60	193	5	18.52	31.57	41.74	50.01	57.00	Sand box.
70	Monomoy, edge of clam flat,	4	Coarse sand, .	1.5	1.024	12.61	216	5	19.69	33.59	44.19	52.76	59.93	Sand box.
71	Monomoy, edge of clam flat,	4	Coarse sand, .	1.5	1.024	15.28	283	5	23.78	40.30	52.14	61.44	68.88	Sand box.
72	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	27.15	714	5	36.64	58.06	71.79	80.70	86.47	Sand box.
73	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.66	645	5	34.90	55.14	69.56	78.74	84.85	Sand box.
74	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.23	627	5	34.40	55.29	68.89	78.13	84.34	Sand box.
75	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.94	657	5	35.23	56.36	69.99	79.14	85.18	Sand box.
76	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.99	660	5	35.29	56.43	70.06	79.21	85.24	Sand box.
77	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	24.16	580	5	33.16	53.67	67.09	76.46	82.93	Sand box.
78	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.50	638	5	34.72	55.70	69.31	78.52	84.66	Sand box.
79	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.68	646	5	34.93	55.97	69.59	78.77	84.87	Sand box.
80	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	26.41	634	5	35.78	57.07	70.70	79.75	85.68	Sand box.
81	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	26.21	670	5	35.55	56.77	70.40	79.49	85.47	Sand box.
82	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	23.33	547	5	32.19	52.40	65.75	75.03	81.71	Sand box.
83	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	25.25	628	5	34.43	55.32	68.93	78.17	84.37	Sand box.

84	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	24.59	599	5	33.65	54.34	67.83	77.05	83.51	Sand box.
85	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	26.12	666	5	35.44	56.63	70.26	79.38	85.38	Sand box.
86	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	19.14	398	5	27.30	45.51	58.19	67.79	75.06	Sand box.
87	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	20.38	441	5	28.74	47.61	60.58	70.20	77.31	Sand box.
88	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	24.74	605	5	33.83	54.57	68.09	77.39	83.72	Sand box.
89	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	20.42	442	5	28.79	47.68	60.65	70.27	77.38	Sand box.
90	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	25.91	656	5	35.19	56.31	69.94	79.09	85.14	Sand box.
91	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	25.80	651	5	35.07	56.15	69.77	78.94	85.01	Sand box.
92	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	22.86	529	5	31.64	51.66	64.98	74.24	81.02	Sand box.
93	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	21.91	497	5	30.53	50.14	63.34	72.85	79.75	Sand box.
94	Monomoy, raft, . .	4	Coarse sand, .	6.0	1.024	26.12	666	5	35.44	56.63	70.26	79.38	85.38	Sand box.
95	Monomoy, raft, . .	4	Coarse sand, .	15.0	1.024	21.36	477	5	29.89	49.24	62.39	71.98	78.94	Sand box.
96	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.00	617	5	34.13	54.94	68.54	77.81	84.07	Sand box.
97	Monomoy, raft, . .	4	Coarse sand, .	10.0	1.024	23.76	564	5	32.69	53.06	66.43	75.78	82.35	Sand box.
98	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	26.86	700	5	36.31	57.74	71.37	80.34	86.16	Sand box.
99	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	26.23	671	5	35.57	56.80	70.43	79.52	85.49	Sand box.
100	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	25.84	653	5	35.11	56.21	69.83	78.99	85.06	Sand box.
101	Wellfleet, north of Egg Island.	5	Coarse sand, .	Exposed.	1.024	27.21	716	5	36.71	58.25	71.88	80.78	86.53	Sand box.
102	Wellfleet, north of Egg Island.	5	Sand, . .	Exposed.	1.024	29.47	819	5	39.34	61.39	75.01	83.46	88.83	Sand box.
103	Wellfleet, north of Egg Island.	5	Sand, . .	Exposed.	1.024	31.09	903	5	41.23	63.69	77.08	84.16	89.58	Sand box.
104	Wellfleet, north of Egg Island,	5	Sand, . .	Exposed.	1.024	26.72	694	5	36.14	57.53	71.16	80.16	86.01	Sand box.
105	Wellfleet, north of Indian Neck.	5	Sand, . .	Exposed.	1.024	20.52	446	5	28.91	47.85	60.84	70.47	77.56	

Table V. — Continued.

No. of Experiment.	Location.	Current.	Soil.	Depth of Water in Feet at Low Tide.	Salinity.	Annual Growth in Millimeters.	Gain Per Cent. in Volume.	Size in Millimeters at Various Ages.						Remarks.
								½ Yr.	1½ Yrs.	2½ Yrs.	3½ Yrs.	4½ Yrs.	5½ Yrs.	
106	Wellfleet, north of Indian Neck.	4	Sandy mud, .	Exposed.	1.024	16.50	315	5	24.23	40.98	52.98	62.32	69.72	
107	Wellfleet, north of Indian Neck.	2	Sandy mud, .	Exposed.	1.024	3.88	55	5	9.06	13.42	18.09	22.48	26.55	Bed high, near shore.
108	Wellfleet, south side of Herring River.	5	Sandy mud, .	Exposed.	1.022	21.78	492	5	30.38	49.93	63.12	72.64	79.56	
109	Wellfleet, south side of Herring River.	5	Sandy mud, .	Exposed.	1.022	19.81	420	5	28.08	46.66	59.48	69.09	76.29	
110	Wellfleet, south side of Herring River.	2	Sandy mud, .	Exposed.	1.022	6.06	90	5	11.71	19.01	25.76	31.73	37.03	Bed high, near shore.
111	Wellfleet, south side of Herring River.	5	Sand, . .	Exposed.	1.022	27.92	750	5	37.54	59.25	72.87	81.65	86.28	
112	Wellfleet, south side of Herring River.	1	Soft mud, .	Exposed.	1.022	1.83	25	5	6.75	8.64	10.71	12.86	15.05	Mud hole in thatch.
113	Wellfleet, south side of Blackfish Creek.	4	Coarse sand, .	Exposed.	1.024	9.09	144	5	15.59	26.38	35.20	42.60	48.96	
114	Wellfleet, south side of Blackfish Creek.	5	Coarse sand, .	Exposed.	1.024	13.32	233	5	20.51	33.03	45.87	54.64	61.90	
115	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	8.32	129	5	14.60	24.59	32.97	40.05	46.17	
116	Wellfleet, west of Indian Neck.	4	Sand, . .	Exposed.	1.024	6.63	100	5	12.43	20.42	27.59	33.87	39.41	Exposed longer than No. 117.
117	Wellfleet, west of Indian Neck.	4	Sand, . .	Exposed.	1.024	13.32	233	5	20.51	35.03	45.87	54.64	61.90	
118	Plymouth harbor, Grey's Flat.	4	Mud, . .	Exposed.	1.021	9.07	143	5	15.56	26.34	35.15	42.53	48.90	
119	Wellfleet, west of Indian Neck.	4	Shifting sand, .	Exposed.	1.024	9.52	153	5	16.09	27.28	36.35	43.92	50.41	
120	Wellfleet, west of Indian Neck.	4	Sand, . .	Exposed.	1.024	8.25	128	5	14.51	24.42	32.77	39.82	45.92	Near shore.
121	Wellfleet, west of Indian Neck.	4	Sand, . .	Exposed.	1.024	12.34	210	5	19.37	33.06	43.55	52.04	59.16	
122	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	10.86	177	5	17.66	30.06	39.87	47.91	54.76	
123	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	7.97	123	5	14.15	23.75	31.93	38.87	44.88	

124	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	9.38	150	5	15.92	26.99	35.97	43.49	49.93	
125	Wellfleet, north side of Blackfish Creek.	3	Sand, . .	Exposed.	1.024	3.88	55	5	9.06	13.42	18.09	22.48	26.55	High, near shore.
126	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	6.49	98	5	12.26	20.07	27.15	33.34	38.83	
127	Wellfleet, north side of Blackfish Creek.	3	Sand, . .	Exposed.	1.024	5.15	75	5	10.58	16.73	22.71	28.07	32.90	
128	Wellfleet, north side of Blackfish Creek.	3	Sand, . .	Exposed.	1.024	2.19	30	5	7.16	9.48	12.01	14.62	17.21	
129	Wellfleet, north side of Blackfish Creek.	4	Sand, . .	Exposed.	1.024	13.18	230	5	20.35	34.71	45.56	56.27	61.53	
130	Wellfleet, west of Indian Neck.	2	Sand, . .	Exposed.	1.024	5.57	82	5	11.10	17.78	24.13	29.77	34.81	High bed.
131	Wellfleet, west of Lieutenant's Island.	4	Sand. . .	Exposed.	1.024	13.89	248	5	21.17	36.13	47.23	56.12	63.45	
132	Wellfleet, west of Lieutenant's Island.	4	Sand, . .	Exposed.	1.024	8.39	130	5	14.69	24.75	33.17	40.28	46.43	
133	Wellfleet, west of Lieutenant's Island.	4	Sand, . .	Exposed.	1.024	7.05	107	5	12.96	21.46	28.94	35.45	41.16	
134	Wellfleet, west of Lieutenant's Island.	4	Sand, . .	Exposed.	1.024	11.42	189	5	18.31	31.21	41.28	49.50	56.46	
135	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	10.58	172	5	17.33	29.48	39.14	47.09	53.87	
136	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	12.90	223	5	20.02	34.15	44.87	53.53	60.75	
137	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	15.93	298	5	23.56	39.95	51.73	61.00	68.45	
138	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	12.90	223	5	20.02	34.15	44.87	53.53	60.75	
139	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	14.95	275	5	22.42	38.10	49.57	58.68	66.09	
140	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	15.72	293	5	23.32	39.55	51.26	60.51	67.95	
141	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	12.13	205	5	19.13	32.64	43.05	51.48	58.57	
142	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	9.52	151	5	16.09	27.28	36.35	43.92	50.41	
143	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	14.95	275	5	22.42	38.10	49.57	58.68	66.09	
144	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	14.88	273	5	22.34	37.96	49.42	58.51	65.91	
145	Wellfleet, north of Egg Island.	5	Sand, . .	Exposed.	1.024	13.25	232	5	20.43	34.84	45.70	54.45	61.71	
146	Wellfleet, north of Egg Island.	3	Sand, . .	Exposed.	1.024	7.12	110	5	13.06	21.63	29.17	35.71	41.44	

Table V. — Concluded.

No. of Experiment.	Location.	Current.	Soil.	Depth of Water in Feet at Low Tide.	Salinity.	Annual Growth in Millimeters.	Gain Per Cent. in Volume.	Size in Millimeters at Various Ages.						Remarks.
								½ Yr.	1½ Yrs.	2½ Yrs.	3½ Yrs.	4½ Yrs.	5½ Yrs.	
147	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	10.93	179	5	17.74	30.21	40.05	48.11	49.98	
148	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	7.54	115	5	13.60	22.68	30.54	37.27	43.14	Near shore.
149	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	8.18	127	5	14.42	24.25	32.56	39.58	45.66	
150	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	9.59	152	5	16.17	27.43	36.54	44.13	50.65	
151	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	7.68	118	5	13.78	23.03	30.99	37.79	43.71	
152	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	3.74	55	5	8.91	13.11	17.61	21.88	25.83	High bed.
153	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	9.66	154	5	16.25	27.58	36.72	44.35	50.88	
154	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	10.50	170	5	17.24	29.32	38.93	46.86	53.62	
155	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	7.97	123	5	14.15	23.75	31.93	38.87	44.88	
156	Wellfleet, Great Island Meadows.	3	Pebbles, . .	Exposed.	1.024	9.17	145	5	15.68	26.55	35.41	42.84	49.23	
157	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	5.64	83	5	11.18	17.95	24.36	30.05	35.13	
158	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	3.95	56	5	9.14	13.57	18.33	22.78	26.91	
159	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	5.92	88	5	11.53	18.66	25.30	31.18	36.41	
160	Wellfleet, Great Island Meadows.	3	Sand, . .	Exposed.	1.024	3.38	47	5	8.53	12.32	16.38	20.32	23.99	
161	Wellfleet, south of Lieutenant's Island.	2	Sand, . .	Exposed.	1.024	5.78	85	5	11.36	18.31	24.83	30.61	35.77	
162	Wellfleet, south of Lieutenant's Island.	2	Sand, . .	Exposed.	1.024	2.12	29	5	7.07	9.31	11.74	14.27	16.80	
163	Wellfleet, south of Lieutenant's Island.	2	Sand, . .	Exposed.	1.024	2.12	29	5	7.07	9.31	11.74	14.27	16.80	
164	Wellfleet, south of Lieutenant's Island.	2	Sand, . .	Exposed.	1.024	4.24	60	5	9.49	14.34	19.42	24.11	28.42	

165	Wellfleet, north of Egg Island.	5	Sand, . .	Exposed.	1.024	14.59	266	5	22.00	37.42	48.78	57.82	65.20	
166	Wellfleet, north of Egg Island.	4	Sand, . .	Exposed.	1.024	7.68	118	5	13.78	23.03	30.99	37.79	43.71	
167	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	12.69	218	5	19.69	33.74	44.38	52.97	60.15	
168	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	12.06	203	5	19.05	32.51	42.88	51.29	58.37	
169	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	9.31	147	5	15.84	26.84	35.79	43.27	49.70	
170	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	11.07	182	5	17.90	30.49	40.41	48.52	55.41	
171	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	11.35	188	5	18.23	31.06	41.11	49.30	56.25	
172	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	9.38	150	5	15.92	26.99	35.97	43.49	49.93	
173	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	10.15	163	5	16.83	28.60	38.02	45.83	52.51	
174	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	11.91	200	5	18.88	32.21	42.51	50.88	57.93	
175	Wellfleet, Egg Island, .	5	Coarse sand, .	Exposed.	1.024	8.04	124	5	14.23	23.91	32.15	39.10	45.16	
176	Wellfleet, Sow Rock Bar, .	5	Coarse sand, .	Exposed.	1.024	5.15	75	5	10.58	16.73	22.71	28.07	32.90	High bed.
177	Monomoy, raft, . .	4	Coarse sand, .	5.0	1.024	19.95	422	5	28.24	46.89	59.75	69.36	76.55	Sand box.
178	Wellfleet, south of Lieutenant's Island.	2	Sandy mud, .	Exposed.	1.024	2.89	40	5	8.00	11.22	14.66	18.13	21.39	Eelgrass.
179	Wellfleet, south of Lieutenant's Island.	2	Sandy mud, .	Exposed.	1.024	2.54	35	5	7.58	10.35	13.34	16.38	19.30	
180	Wellfleet, south of Great Beach Hill.	1	Sand, . .	Exposed.	1.024	.85	11	5	5.76	6.57	7.42	8.33	9.27	High bed.
181	Wellfleet, south of Great Beach Hill.	1	Sand, . .	Exposed.	1.024	.99	13	5	5.88	6.83	7.84	8.91	10.02	High bed.
182	Wellfleet, south of Great Beach Hill.	1	Sand, . .	Exposed.	1.024	.21	3	5	5.19	5.39	5.60	5.81	6.04	High bed.
183	Wellfleet, south of Great Beach Hill.	1	Sand, . .	Exposed.	1.024	.56	7	5	5.50	6.03	6.59	7.19	7.71	High bed.
184	Wellfleet, east of Great Beach Hill.	3	Gravel, . .	Exposed.	1.024	2.54	35	5	7.58	10.35	13.34	16.38	19.30	Near shore.
185	Wellfleet, east of Great Beach Hill.	3	Sand, . .	Exposed.	1.024	2.75	38	5	7.83	10.87	14.14	17.42	20.55	Near shore.
186	Plymouth Harbor, Egobert's Flat.	4	Fine sand, .	Exposed.	1.021	11.73	197	5	18.67	31.84	42.06	50.37	57.39	
187	Plymouth Harbor, Egobert's Flat.	4	Fine sand, .	Exposed.	1.021	7.43	113	5	13.45	22.41	30.18	36.86	42.70	Eelgrass.

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During the past four years the investigations at Wellfleet were carried on to determine the practicability of securing a "catch of oyster spat" in Wellfleet Bay. The catching of spat is a very important advantage to the oyster industry.

The report of Mr. Belding follows: —

OBSERVATIONS ON THE SET OF OYSTER SPAT IN WELLFLEET BAY.

The future success of the Massachusetts oyster industry will depend not only upon producing oysters of good quality and accessible markets, but also upon the raising of seed oysters. At the present time the problem of obtaining small oysters is an important factor in the development of the industry, since the greater part of the seed is brought from Long Island Sound, the Massachusetts oysterman paying the added cost of transportation. By raising native seed other difficulties, such as the inability to obtain suitably small oysters for planting and the prohibitive prices in years of poor set in Long Island Sound, will be eliminated, and the oyster industry in the Commonwealth placed on a more substantial basis.

Owing to variable natural conditions the control of the oyster set, in spite of numerous investigations in this country and abroad, has proved a baffling problem, which, possibly, may never be satisfactorily solved. At the present time young oysters can be caught, with more or less uncertainty, by placing shells in the water during the spawning season, the planter having no means of foretelling whether he will get a good or a poor set. Except in Buzzard's Bay and the Taunton River, where there were once natural oyster beds, little attempt has been made to catch the natural set, the Cape Cod planters obtaining their seed outside the Commonwealth. The object of this paper is to present a few facts concerning spat collecting, with the hope that it may arouse renewed interest in the production of native oyster seed. The following observations in Wellfleet Bay, in spite of their limited scope, show that oyster spat can be collected artificially in localities commonly considered unproductive, and that similar results can be obtained in other sections where spat collecting has not been given a fair trial by the oystermen.

The following report consists of an introductory section, briefly dealing with the natural history of the oyster in as far as it relates to general spat collecting, a description of the conditions in Wellfleet Bay, and the results obtained from an investigation of the spawning season and from experiments with spat collectors. The methods of work are described under each topic.

Natural History.

Spawning. — The American oyster (*Ostrea virginica*) is unisexual, whereas the European species (*Ostrea edulis*) is hermaphroditic, *i.e.*, both sexes occur in the same animal. The ripe generative organs (Fig. 62), in either sex, surround the liver and intestine, giving the appearance of branching veins filled with creamy white contents. The eggs or spermatozoa, during the act of spawning, are extruded from

two main ducts, opening, one on each side, below the large adductor muscle, and are swept from the mantle chamber into the water, where they unite with the spawn from another oyster of the opposite sex. The oyster ready to spawn is popularly said to be "in milk," owing to the white, milky appearance of the reproductive organs. In Massachusetts waters the oyster begins to spawn at the age of two years, but its greatest activity does not take place before the fourth or fifth year.

Fecundation. — According to the late Prof. W. K. Brooks of Johns Hopkins University the average female oyster is capable of producing 16,000,000 eggs per season. The extruded eggs, about 1/400 of an inch in diameter, can be seen by the naked eye as tiny white specks, which under the microscope have a round opaque appearance, due to the yolk granules within the cell. The spawn of the male oyster has a uniform milky consistency, due to the great number of minute spermatozoa, which mainly consist of a nucleated body and long slender tail. In this way nature has provided a division of labor, since the egg is the inactive form, which contains the nutriment, while the spermatozoön is modified for swimming in search of the egg.

In order that the egg, which has been cast off from the parent oyster, shall develop into a new individual, it must unite with a spermatozoön, the act of fusion being known as fecundation or fertilization. In nature the meeting of these two is often a matter of chance, depending upon the simultaneous spawning of several oysters in the same locality, and probably numbers of eggs are never fertilized.

Early Life History. — With the completion of spawning the adult oysters have fulfilled their parental duties and the developing embryo is at the mercy of the natural elements. In order to overcome such adverse conditions as sudden changes in temperature, cold rains, storms, freshets, as well as the active enemies of the young larvæ, and in order to maintain the proper equilibrium in spite of this great destruction, nature has provided an enormous number of eggs for every female oyster.

During the first few hours, if the temperature of the water is not below 70° F., the embryo develops by the usual method of unequal cell division, and passes successively through 2, 4, 8, 16, 32, etc., celled stages, until it finally becomes a mass of small cells surrounding a few large cells, which are to form the primitive digestive tract. In the course of a few hours these surface cells throw out fine hair-like processes, cilia, which by their lashing enable the animal first to rotate and then to swim through the water. The body soon elongates; cilia are only visible on the front end; the primitive mouth is formed on the under surface; and the shell gland is developed opposite the mouth. Gradually a thin, transparent shell envelops the body, the cilia on the anterior end forming a thick pad, the velum or swimming organ, which permits the little shelled larva to lead a free-swimming existence.

The formation of a mouth, stomach, intestine and anus enable the young animal to digest minute organisms and to obtain its sustenance from the water. During this veliger period the oyster larvæ can readily be taken by towings with the plankton net.

Attachment. — About the sixth day, the length of the free-swimming period depending upon the temperature of the water, the embryo settles to the bottom, and, if fortunate, attaches itself to some hard clean surface by the edges of the mantle, a fleshy fold on the inside of the shell. This temporary attachment is soon replaced by a calcareous fixation which firmly fastens the oyster by its left or deep valve to the object of support. The attachment is caused by a sticky secretion from the mantle which becomes impregnated with lime salts. Several instances have been observed on the gravel bar in Herring River, Wellfleet, where yearling oysters had made a second attachment at the edge of the shell, leaving an interval between the two pebbles (Fig. 68: 16). This fact indicates that the oyster at the age of one year still retains its power of attachment.

Previous to the attachment the early straight-hinged veliger larva has changed in size and shape to an unequivalvular form, with prominent umbones pointing posteriorly, which is readily recognizable under the microscope. During the early attachment period the anterior adductor muscle disappears, the gill filaments increase in number, and a different shell formation takes place.

Spat Collecting.

The present system of spat collecting developed from a study of the attachment habit in the young oyster, the planters finding that they could aid nature during the spawning season by placing in the water suitable objects on which the larvæ would set. The oyster will fasten to any hard clean surface, often on unusual objects, as old shoes, rubber boots, tin cans, clay pipes, glass bottles, and many other articles which occasionally find their way into the water. At Monomoy Point a large lobster was captured with five oysters, two and one-half months old, attached to its shell.

In America various shells have been utilized for cultch. In Massachusetts the oyster shell, most popular in other States, is generally considered second to the scallop, which, of a more fragile nature, readily allows the breaking apart of the clustered oysters. The heavier oyster shell does not break as easily, and consequently, unless the clusters are separated by hand, the oysters either die or take on an elongate form from lateral pressure. Oyster shells are preferred for exposed waters, scallop for quiet localities where the light shells will not be washed away. Clam, mussel, razor clam, silver or jingle shells, as well as gravel and small stones, are occasionally used. In Europe intensive oyster culture demands more elaborate methods, and various

combinations of brush, bamboo, rope, tile and cement are used to catch the spat.

In the United States spat is collected both in the deep water and beween the tide lines. The former method is used in Long Island Sound, where the cultch is planted in water as deep as 40 feet; the latter in Massachusetts, where the seed is taken mostly between the tide lines (Fig. 64). The waters at the head of Buzzard's Bay, formerly the site of several natural oyster beds, yield an abundant harvest from the planting of shells on the gravel bars in brackish water. Outside of Buzzard's Bay and Narragansett Bay little spat collecting is carried on in Massachusetts, the planters preferring to buy their seed outside the State.

In placing the spat collectors the planter should have in mind two things: first, the desirability of a hard bottom to support the shells; secondly, the danger of planting the shells too early. In certain cases it is profitable to artificially harden the bottom with stones or gravel before planting. After the shells have been in the water for a short time, they become covered with a slimy growth of microscopic plants, which renders impossible the attachment of the young oyster. For this reason, except in favored localities, where the growth of the slime is slow, the oysterman must needs wait until the spawning season is well under way before placing his shells in the water. Even then the conditions determining a set are so erratic that the oysterman does not average more than one good set in every three to four years.

In Massachusetts the oyster industry is regulated locally by the various coast towns, and spat collecting is permitted under the following conditions:—

> The mayor and aldermen of a city or selectmen of a town may, by writing under their hands, grant a license for a term not exceeding ten years to any inhabitant thereof . . . to plant oyster shells for the purpose of catching oyster seed, upon and in any waters, flats and creeks therein, at any place where there is no natural oyster bed; not, however, impairing the private rights of any person, nor materially obstructing any navigable waters. . . . The shore line of such licensed premises shall be . . . the line of high water for the planting of oyster shells, but the provisions of this section shall not authorize the placing of such shells upon the land of a riparian owner between high and low water mark without his written consent.

Conditions in Wellfleet Bay.

During the summer of 1908 a series of observations was made upon the oyster set in Wellfleet Bay. In this locality the planters, after a few unsuccessful attempts, had gradually reached the conviction that the capture of oyster spat in Wellfleet Bay was almost an impossibility. With the object of possibly discovering a remedy for this condition, the following plan of investigation was outlined: (1) a survey

of the natural oyster set in the bay; (2) observations on the spawning and larvæ in the water; (3) experiments with spat collectors in the different parts of the Bay.

Wellfleet Bay. — Wellfleet Bay, an arm of Cape Cod Bay some 4 miles long and 2 miles wide, has an extensive area of flats, owing to the great rise and fall of the tide (10¾ feet). For this reason practically all the set is found between the tide lines, although spat is occasionally noticed on the oysters planted in the deep water. The flats vary in composition from gravel to soft mud, but for the most part consist of a dark coarse sand. The tide flows swiftly, causing a slight shifting of the flats, especially in the lower part of the bay, and forming numerous sand and gravel bars, such as Stony, Smalley's, Blackfish Creek and Herring River bars. At the head of the bay, on the east and west sides, are two inlets, Duck Creek and Herring River, while half way down on the east side is Blackfish Creek. At low tide little remains of these tributaries except streams in the channel bed. The two principal sand bars are Smalley's Bar, opposite Blackfish Creek, and Egg Island, at the northern end of the bay.

The Wellfleet Oyster Industry. — In any consideration of the set it is essential to know the amount of adult spawning oysters on the beds. In 1908, when the greater part of our observations were made, there were but 70,000 bushels of oysters planted in the bay. Of this number, 68,000 were three-year-old oysters, the remainder seed. Five and six-year-old oysters were found in scattering quantities near Indian Neck, in the northern part of the harbor. In spite of the small number and size of the spawning oysters a comparatively heavy set occurred in 1908, which indicates that favorable weather conditions during the spawning season are more important than the number of spawners. In 1909 approximately the same number of oysters were on the beds, but being older were capable of producing more spawn. In 1910 and 1911, owing to the development of the Wellfleet industry by new companies, a considerably larger number of oysters were planted.

Previous Attempts at Spat Collecting. — The first settlers in Wellfleet found a natural oyster bed in the vicinity of Hitchin's Creek or Silver Spring in 1644. In 1775 this natural bed was completely destroyed and was never replenished, owing to the lack of suitable objects on which the spat could catch. Until 1908 the only successful spat collecting had been in Herring River, where two set, the last in 1906, had been obtained by Mr. E. P. Cook of Wellfleet. Various attempts have been made in other parts of the bay by the oystermen, with indifferent success.

Preliminary Survey. — The main problem was to determine whether the prevailing opinion that unfavorable natural conditions rendered spat collecting impossible was true or whether it had arisen through lack of initiative and erroneous methods. The first step in the solution of

this problem was a general survey of the oyster set of previous years in order to determine the most productive localities. For this purpose an examination of the rocks, gravel bars, wharf pilings, stakes, etc., was made for evidences of set.

The result of the survey indicated that artificial spat collecting could be carried on successfully, as was later substantiated by the experimental collectors. The observations were briefly as follows: —

(1) The greater part of the oyster set took place between the tide lines, which limited the area for placing the experimental spat collectors.

(2) Sufficient evidence was found of the natural abundance of larvæ in the water, as in the favorable localities whenever a clean surface was presented a few spat could be found attached, the chief difficulty being the lack of suitably raised collectors. The number of oysters from one to three years old, attached to the piling and stones under Commercial and Chequesset Inn wharves (Fig. 66), as well as the quantity of living and dead oysters on the stones, pebbles and large rocks in nearly every part of the bay, gave promise of an abundant natural production.

(3) The localities of the greatest natural set appeared to be Herring River, Blackfish Creek and the bar south of Jeremy's Point, locally known as Stony Bar.

The Plankton Net.

The importance of determining the spawning season and time of set in Wellfleet Bay was early evident, since such information not only would show the proper time to put down our spat collectors, but also, when continued through a series of years, would prove of value to the local oyster planters. For this reason the first step in our investigation was directed toward a study of the spawning habits of the oyster in this locality.

Methods of Investigation. — Beginning in May examinations were made at definite intervals to determine the condition of the spawn in the adult oysters on the grants. Information was also gathered from the oystermen as to when the oysters were "in milk," and at what times in previous years spat had been observed, a method which, although helpful, did not give as definite results as the plankton net, and which, after 1908, was used only for general reference.

The general usefulness of the plankton net, which has been used extensively in the study of microscopic life in the water, suggested that it might prove of value in determining the presence of the free-swimming oyster larvæ previous to the time of set. In the past little attention has been given to the shellfish larvæ in the veliger or free-swimming stage, and merely the abundance or scarcity of any year noted. An endeavor was made to make our work roughly quantitative

by using stated distances, same period of tide and a uniform method of counting the larvæ with the microscope and Rafter cell.

The tow net was made of No. 11 silk bolting cloth, supported from a copper ring 12 inches in diameter by a fold of canvas. The net was towed behind a dory near the surface of the water at a uniform rate of speed, which permitted the water to filter through the fine meshes, leaving the plankton or floating organisms. A uniform speed was essential, as too rapid movement would result in the backing of water from the net, owing to the difficulty of filtering, and too slow a rate would allow the net to sink. The variation in current, tide and wind likewise rendered difficult the filtration of the same amount of water at each towing, so that the counting was only roughly comparable. Except in protected inlets any quantitative work with a simple net in sea water necessarily has to allow for these errors. As the same distance, a round trip of 600 feet off Chequesset Inn wharf, was taken for each towing, and only approximate results desired, the value of the work from a practical standpoint was little affected.

The second step was the separation of the oyster and other shellfish larvæ from the miscellaneous plankton forms in the towing, which had been washed into a small pail containing about 3 inches of water. The water was given a whirling motion with a small stick, which forced the larvæ by centripetal action to the center of the pail, where they could be easily taken out with a pipette. The operation was repeated several times to obtain all the larvæ. If, perchance, sand had been taken in the towing, it would also settle to the center with the lamellibranch and gasteropod larvæ, but the larger grains could be separated later by proper manipulation in small glass dishes. No satisfactory method of separating the fine sand grains or gasteropod larvæ from the lamellibranch veligers could be devised, except the laborious method of picking out the individuals with a fine pipette. However, their removal was not essential, since they did not materially interfere with the counting.

The method of counting is an adaptation of the Sedgwick-Rafter device for counting diatoms and algæ. The larvæ are spread evenly in a Rafter cell, consisting of a brass rectangle, 1 millimeter high, 20 millimeters wide and 50 millimeters long, fitted onto a glass slide and having a volume of 1,000 cubic millimeters, or 1 cubic centimeter. By means of a ruled square in the ocular of the microscope, covering 1 square millimeter of surface on the slide, the larvæ are counted from ten different areas and the result multiplied by 100 to give the entire number, which, if the distribution in the cell is even, proves a fair estimate.

Results.

The Oyster Larva. — The duration of the veliger or free-swimming period is variable, the temperature of the water having a great influence on the rapidity of larval development. During this stage certain

anatomical changes occur which render the animal capable of forsaking the free-swimming existence and ready to lead a stationary life. It is difficult to distinguish the oyster from the other shellfish at this period, the early veligers of many lamellibranchs having the same flat hinge line. It is only during the last days of the veliger stage that the final characteristics which differentiate it from the quahaug, clam, scallop and other shellfish appear. The oyster just previous to the time of set has an equi-valvular shell with projecting umbones (beak) pointing posteriorly. The convex left valve is larger than the right and forms the greater part of the characteristic hump-like umbones.

The appearance in the towings of the larva with prominent umbones marks the time for immediately putting down the shell spat collectors. Recognition of the young oyster at this period by the plankton net and microscope should prove of value to the oyster planters, especially in the localities where the natural conditions, favorable for the growth of minute animal and vegetable life in the water, render a short submergence of the shells imperative. In Buzzard's Bay the oysterman considers it important to know the exact time of set in order to prevent his shells becoming covered with a slime, which would interfere with the attachment of the spat. In this respect conditions are more favorable at Wellfleet, the shells sliming but little. It is to be regretted that our method of determining the exact time of set, since it depends upon microscopical examination of the larval oysters, cannot become of popular use among the practical oystermen of the Commonwealth.

The Spawning Season. — In Wellfleet Bay the spawning season approximately extends from the middle of June to the middle of August; but the greater part of the spawn is liberated during the last week in June and the first two weeks in July. The actual spawning of the individual oyster is probably of brief duration, and the long season is best explained by the variation in the ripening of the different oysters. Observations of the spawning season for four years gave the following data: in 1908 microscopical examinations of the eggs showed that a few oysters had begun to spawn as early as June 12, but that the season practically did not start until June 23; by July 10 the majority of oysters in the upper part of the bay had ceased spawning, while the oysters in the lower part, where the water was cooler, were not so far advanced. In 1909 the main spawning took place between June 26 and July 10, followed by a second period between July 22 and July 31. In 1910 the first spawning occurred between June 24 and July 1, the second from July 13 to July 22, and scattering larvæ were found in the water from July 27 to August 12. In 1911 the first spawning came between June 28 and July 5, the second from July 19 to July 22, and scattering larvæ were found from July 26 to August 24. According to these records the principal spawning takes place during the last week in June and the first two weeks in July, with a slight

variation for the different years. The subsequent spawning evidently depends upon variable temperature conditions, and exhibits no regularity.

Temperature and Spawning. — The temperature of the water was the chief factor regulating the spawning, which took place at 70° F. or over. The 1911 season was slightly later than 1909 and 1910, owing to the cold weather during June. The temperature of the water in the upper part of Wellfleet Bay followed closely the weather changes, the action of the sun on the flats exposed at low tide rapidly raising the temperature several degrees. The sudden bursts of spawning were invariably preceded by a high temperature of the water, brought on by the hot weather, the month of July, during which most of the spawning took place, averaging 3 degrees warmer than the month of August. In general, the time of spawning could be told from the condition of the weather and the temperature of the water, the observant oysterman invariably predicting an early or late season.

The Destruction of Larvæ. — The numerous offspring of the oyster maintain a continuous struggle for existence against the adverse forces of nature. In our study with the plankton net a few observations were made on the effect of cold rains upon the larval oyster and other shellfish. In most cases the rain either caused the destruction of the swimming larvæ or forced them to settle to the bottom. At Monomoy Point, Mass., during a long, cold rain, counts were made of the number of larvæ in a certain amount of water which passed through the plankton net: before the rain, 30,000; after nine hours, 15,000; after fifteen hours, 3,000. After the rain ceased the number of larvæ gradually increased, until it was the same as at the first counting.

The years of the best set have had little or no rain during the brief free-swimming period, thus affording no drawback to the development of the larva. The conditions causing set are varied, complex and constantly changing. A set is achieved by a happy combination of favorable conditions largely presided over by the element of chance, and for this reason will always remain a more or less baffling problem to the oysterman, who in his feeble way is unable to control the mighty forces of nature.

Spat-collecting Experiments.

In connection with the use of the plankton net small shell collectors were put down in order to determine the values of the different parts of the bay and to ascertain the natural conditions influencing spat collecting. Seventy-four collectors, consisting of ½ to 1 bushel of shells, were placed between the tide lines in the selected localities, and covered with galvanized wire netting, 1-inch mesh, securely fastened to the flat by four short stakes, in order to prevent the contents from washing away in the strong currents. The final result showed a little mound of shells, 6 to 8 inches high, covering perhaps 5 square feet. By this simple device it was possible at a small expense to test a large

territory with more satisfactory results than by using a few large collectors. In studying any particularly favorable locality, such as a sand or gravel bar, a series of collectors were placed at definite intervals to determine the most favorable part.

Three difficulties which unfavorably influenced the results were encountered: (1) the shells were difficult to obtain and the greater part of the collectors consisted of razor clam shells, a form less suitable for catching spat than the scallop or the oyster shell; (2) the extreme lowness of the shell heaps, not over 8 inches above the surface of the flat, rendered the small collectors less efficient than larger heaps; (3) part of the collectors were planted late in the spawning season, July 11 to July 24, and possibly may have missed the heavier part of the set. They were taken up September 7 to October 14, the more important being taken up first. By this time the young oysters were of a readily discernible size.

Location of the Collectors. — Seventy-four collectors were placed between the tide lines around the bay, from Billingsgate Island on the west to the south side of Lieutenant's Island on the east, a distance of nearly 7 miles. In Herring River and Blackfish Creek were long, tongue-shaped bars over which the tide flows swiftly. On these a series of collectors from high to low water mark were set out to find at what depth of water the greatest abundance of set occurred. A second series at right angles to the first were placed across the bar in the direction of the tide flow, to determine whether the set took place on the outer edge, mid surface or inner edge of the bar. In the other parts of the bay the more isolated collectors were usually placed in pairs, one near high, the other near low water mark.

Results. — Of the 74 collectors, 26 were washed away, the greatest loss taking place in Blackfish Creek, near the Chequesset Inn and Egg Island, Jeremy's Point and Billingsgate Island. The condition of the remaining 48 can be classified as follows: (1) good, 14, mostly in Herring River and Blackfish Creek; (2) fair, 18; (3) poor, 16. Only in one place were the collectors a decided disappointment, on the north side of Blackfish Creek, where the entire bar shifted with the early autumn gales, either burying or washing away the small shell heaps.

When taken up only 18 collectors out of the 48 which were recovered had caught any spat. The following table gives location, the number of collectors, the percentage of shells found and the relative value of the locality in terms of the amount of spat. The collector with the greatest number of young oysters was taken as the standard and given 400 per cent. Since a collector which contained 10 per cent. of the original shells could not capture as much spat as one with 50 per cent., it was necessary, in determining the relative value of the locality, to allow for this difference by estimating the catch for the entire collector.

Location.	Number of Collectors.	Per Cent. of Shells.	Value (Per Cent.).
East side of Great Island,	1	25	2.67
East side of Great Island,	2	25	5.33
Herring River,	3	33	6.00
Herring River,	4	25	400.00
Herring River,	5	25	266.67
Herring River,	6	25	8.00
Herring River,	7	25	5.33
Herring River,	8	25	10.67
Herring River,	9	25	2.67
Herring River,	10	25	5.33
Herring River,	11	10	33.33
Indian Neck,	12	10	6.67
Indian Neck,	13	10	6.67
Blackfish Creek,	14	10	6.67
Blackfish Creek,	15	40	5.00
Blackfish Creek,	16	40	6.67
Blackfish Creek,	17	40	41.67
Blackfish Creek,	18	10	13.33

(1) *At what Level between the Tide Lines does the Best Set occur.* — The greater part of the set in Wellfleet Bay occurred between the tide lines, which was due in some measure to the height of the tide, 10¾ feet, and the large area of exposed flats. To determine at what height the set of oysters was most likely to take place, three classifications of the collectors were made, (1) *high,* (2) *medium,* and (3) *low,* according to their situation in regard to low-water mark. Of 47 collectors, 17 were high, 9 low and 21 medium. Of the 18 collectors which caught set, 3 were high, 13 medium and 2 low, showing a per cent. of 72 for the medium in the productive collectors as compared with 45 of the total number. The strip of territory about half way between the tide lines in Wellfleet Bay was the most productive of oyster seed, and recognition of this fact should be taken by the local oyster planters in putting down shells for spat collecting.

(2) *Gravel Bars as Natural Spat Collectors.* — When a long bar projects from the land at the mouth or entrance of a bay, creek or river, it seems to act as a natural spat collector for shellfish, particularly oysters, if there are suitable objects, such as shells or pebbles, on which the set can fasten. The top or highest portion of the bar seems most suitable for the attachment of the young oyster, while the clams and quahaugs are deposited around the edges. It is especially noteworthy

that in Wellfleet Bay the best grounds for the oyster set are the raised bars swept by the tidal currents in Herring River and Blackfish Creek.

(3) *Artificial Bars.* — The preliminary survey showed that the chief difficulty in obtaining oyster set in Wellfleet Bay was due to a lack of raised places for catching the seed. The question then arose as to whether portions of the ordinary flats could not be modified in some manner to afford suitable collecting ground. The problem of raising the level of the chosen locality to make a firm foundation for the shells was considered, and in order to test the efficiency of this plan an unproductive flat of soft mud in Herring River was selected. Several loads of coarse gravel were dumped upon the soft mud until a solid raised platform was built. On this the shell collectors were placed. If the shells had been placed on the mud before it had been covered with the gravel they would soon have been covered with silt. A fair set was obtained on the shells, which proved that by proper means many places on the flats of Wellfleet Bay could be utilized in a similar manner.

The Survey.

About Dec. 1, 1908, a record was taken of the natural conditions in the localities of abundant set and a general survey was made for the purpose of determining the favorable locations of the set in the various parts of the bay, on the bars, flats and large rocks.

The West Side of the Bay. — Passing north from Billingsgate Island the first locality of set was the low gravel bar, locally known as Stony Bar, situated south of Jeremy's Point. The tide passed with great swiftness over the bar, which was exposed only at extremely low running tides, rendering this locality, in spite of its favorable location for an abundant oyster and quahaug set, unsuitable for artificial spat collectors. Here quantities of small oysters were found attached to the gravel and small stones.

The tidal flats on the bay shore of Great Island consisted mostly of yellow or dark colored sand, furnishing no foundation for the set except on the large rocks which were scattered along the shore. Occasionally stones or pebbles covered with small oysters averaging 19 millimeters (4/5 of an inch) in size were gathered. North of the "Meadows," a gravel bed, 40 by 30 feet was covered with a thick set, averaging 14.8 millimeters (3/5 of an inch). The scattering set from this locality to Herring River averaged slightly larger, about 22 millimeters (5/6 of an inch).

The North Side of the Bay. — With the exception of Herring River, which will be described later, the north side showed a similar condition, — a scattering set on the pebbles and stones; but, owing to the greater amount of suitable objects for fixation, the natural set was correspondingly greater. The average size along this shore was 22 millimeters (5/6 of an inch). The heaviest set was found on the wooden piles and rocks under the Chequesset Inn and Commercial wharves, which were

literally covered with young oysters, averaging 20.48 millimeters. Likewise the stakes marking the quahaug beds proved miniature collectors, a single stick often holding as many as 50 spat.

The East Side of the Bay. — The same conditions held true along the entire east shore, a scattering set on all stones and shells exposed from the sand. The rocks on Indian Neck and the west side of Lieutenant's Island were well supplied with spat. On the south side of Blackfish Creek a gravel bar extending from the shore of Lieutenant's Island in a northerly direction proved one of the best situations in the bay for planting shells. The abundance of the natural set and the results from the experimental spat collectors showed that this region ranked next to Herring River in the production of seed oysters. The average size, 13 millimeters (½ inch), was less than in the upper part of the harbor.

The Rocks. — A number of rocks, varying in size from small stones to a circumference of 70 feet, were scattered over the flats along the eastern and western shores. These rocks often occurred in clusters or groups, as at Indian Neck or west of Lieutenant's Island; but occasionally solitary specimens rose abruptly from the sands. The larger of the rocks, known to the quahaug fishermen as Old Sow, Blue Rock, etc., furnished evidence of an abundant natural set, and indicated what might be accomplished, by proper spat collectors, since, with few exceptions, their sides, 2 feet above the sand, were thickly covered with oyster spat. In many instances the young oysters had attached to a previous set and could be readily scraped off the rocks.

On the western side of the bay records were taken of the oyster set on six rocks from 2 to 9 feet in diameter. The average number of oysters per square foot was 41, ranging from 28 to 80, and the average size 12.23 millimeters (½ inch).

Blue Rock, the largest in the bay, having a circumference of 70 feet and rising 12 feet above the sand flat west of Lieutenant's Island, had the heaviest set. The rock lies in a favorable location and is completely covered only during the high course tides. The 1908 set began 1 foot from the bottom, was thickest from 1 to 4 feet and gradually thinned from 4 to 6 feet. The different sides showed variations in the amount of set: the west side averaged 125 per square foot, size, 9.84 millimeters; the east side, 109, size, 6.96 millimeters; the south side, 125, size 10 millimeters; the north side, 53, size, 9.44 millimeters. The size of the set on the small rocks near by varied from 8 to 15.5 millimeters, according to location.

Herring River. — Herring River emptied into the northwest corner of the bay by a deep bend which almost separated Great Island from the main land. Formerly the incoming tide passed swiftly up the river to flood thousands of acres of salt marsh along its numerous branches; but in 1909 the passage of salt water above the first bend was prevented by the construction of a dike. The area concerned in the oyster set lay below the dike, and although the river currents were

somewhat altered, the conditions governing the set in this territory remained unimpaired by the construction of the dike.

Scattering oysters were found on the stones, shells and sedge along the shores. In one instance the projecting sides of a gunning tub, buried in the sedge, had caught 75 spat 15 millimeters in size. Two principal localities of set were found: on the north side of the river were the remains of an old wharf, used in former days for the fishing schooners. Here the old piles and stones were covered with oysters; but owing to the absence of suitable objects for attachment outside the wharf little set was noticeable.

The second locality was a gravel bar on the south side of the river, which proved the best spat collecting territory in the bay. This bar, covering approximately 500 by 150 feet, ran in a northwesterly direction from a point on the north side of Great Island in such a manner that the incoming tide flowed over it diagonally. Between the outer side of the bar and the channel at low tide was an area of shifting sand, while on the south and west a sand and mud flat separated it from Great Island. A series of spat collectors on this bar gave excellent results. The scattering shells, placed on the gravel area by Mr. E. P. Cook of Wellfleet also received a good uniform set. Over this bar 6 shells, averaging per shell 11.5 spat, 18.5 millimeters in size, were found to the square foot.

The great abundance of the set is due to the location of the bar in reference to the natural conditions of current, tide and shore line. The bar presents (1) a peculiar shore formation, guiding the flow of the tidal currents; (2) a high raised surface; (3) heavy material, such as gravel and pebbles, which offer a suitable foundation for the shells as well as serving as spat collectors; (4) the direction and force of the current, which has full sweep over the bar, affording a chance for the floating larva at the proper time to come in contact with suitable objects for attachment.

Conclusions.

(1) The idea of the Wellfleet oystermen that the capture of seed in Wellfleet harbor was impossible has proved erroneous. Our experiments have demonstrated that spat can be successfully gathered if the oystermen will use intelligent perseverance.

(2) At present there is an abundance of natural spat in the waters, but a lack of suitable objects on which it can set. The heavy sets on the gravel bars, rocks and under the wharves are obvious evidence.

(3) The two localities where set is most certain at the present time are the gravel bars in Herring River and Blackfish Creek.

(4) Other localities, particularly on the north end of the bay, can be made productive of oyster set by the formation of artificially raised gravel bars on which to plant the shells.

(5) The set takes place between the tide lines, only a small part striking in the deep water. The heaviest set is about half tide line.

(6) The spawning season lasts from June 15 to August 15, but the principal spawning takes place during the last week in June and the first two weeks in July.

(7) A method of determining by microscopical examination the exact time of oyster set has been tried with success. This is important to the oysterman in deciding at what period he should put down his shells to prevent sliming.

(8) The shell collectors in Wellfleet Bay gather slime slowly, due in part to the long exposure of the flats to the sun and air. Ordinarily the Wellfleet oysterman should put down his shells during the first week in July.

Inland Fisheries.

It appeared to be the opinion of the Legislature that the commissioners should continue to lease the fishing privilege in Tisbury Great Pond to private parties, according to the provisions of Acts of 1910, chapter 529. We have so leased to F. Allen Look *et al.* for a period of three years. A copy of the lease is on file at this office. In view of this fact, the following report upon this pond by William Converse Kendall, assistant, United States Bureau of Fisheries, is of interest: —

An Account of Tisbury Great Pond, Martha's Vineyard, with a List of Fishes collected in October and November, 1906.

In October and November, 1906, Mr. Vinal N. Edwards of the United States Bureau of Fisheries Station at Woods Hole made a large collection of fishes in Tisbury Great Pond, Martha's Vineyard, and has kindly furnished data upon which is based the following account.

Tisbury Great Pond, the aboriginal name of which is said to have been Takisny, is situated on the south side of Martha's Vineyard in the town of Tisbury. Its long axis, lying about east and west, is 2 miles, and its transverse diameter about 1½ miles. From the shores, the bottom, of hard, eel-grass-covered sand, gradually slopes off to a depth of 12 feet near the middle of the pond. From four to five months of the year it is an enclosed pond with no outlet, but with five rather muddy affluent streams, the sources of which are among the hills at the northward. During the summer and early fall the pond is open to the ocean, but about the first of November, or with the first heavy southeast gale, the outlet is blocked with sand. The outlet once blocked would probably forever remain so were it not for the residents near the pond, who with horses drag or dredge out a channel sufficient to allow the water to flow. The surface of the pond is a little higher than the sea level, and the released waters soon cut through the loosened sand of the bar, making a channel from 100 to 200 feet wide and from 3

to 5 feet deep. Owing to the higher level of the pond the sea does not flow into it until about half tide.

The salinity of the pond water varies somewhat in different parts of the pond, and according to whether it is closed or open. The density, as observed by Mr. Edwards in October, during the open season, was 1.0223 to 1.0226 in the portion next to the sea, but in the coves near the inlets it was found to be only 1.008.

There is authentic history of the early importance of the fishery at this pond, particularly for striped bass, smelts and alewives. One record of the former abundance of striped bass is that in December, 1848, 18,000 of those fish were taken by one set of a long shore seine in one of the inflowing streams. They were carted to Vineyard Haven and shipped by two schooners to New York.

Mr. Allen Look, who helped make this famous catch, is still living. About 1870 the pond was leased to Mr. Look and his sons. In 1869 they had planted there 1,200 to 1,400 breeding white perch, which species did not previously exist there. Having wisely allowed them to rest practically undisturbed for about ten years, they began seining, and have taken some 200 barrels each season since. Each season yields also about 200 barrels of eels, all taken in eel pots.

It is said that up to 1875 smelts were very abundant there, and from 600 to 700 barrels were taken annually. Since then, however, there has been a steady decline in the fishery, so that now only 50 or 60 barrels are taken each season.

Large numbers of alewives enter the pond each year and ascend the streams to spawn. The fishery for this species is carried on with a shore seine near the outlet, so that but a comparatively small portion of those that enter the pond are caught. Yet the fishery yields annually about 300,000 alewives.

In the early annual reports of the Commissioners of Inland Fisheries of Massachusetts occur a few letters from Mr. Look regarding the condition of the fishery in the pond. Under date of Oct. 4, 1873, he writes: —

There have been no new kinds of fish put in the pond during the past year, but from the barrel of white perch that was put in on April 1, 1869, we caught last spring 25 barrels of large perch, besides large quantities of small ones, of all sizes. Out of the whole catch we killed and sold 10 barrels of the largest, suffering the rest to escape unharmed. These 10 barrels weighed some 2,000 pounds and gave us net proceeds of $200. This shows with what rapidity white perch will increase if they have a chance. If those we let go increase in proportion to the first barrel, there will be an enormous quantity of them in three years. I think it takes about that time for them to mature. I have seen three distinct sizes, apparently one, two and three years old.

We have been very careful about keeping the pond open to the sea at proper times for the fish to come and go out.

The herring [alewives] have increased very much since the lease was given; they come earlier and are larger.

Smelt fishing was not as good last spring as in former years, owing to the hard winter. Smelts usually come into our ponds in December and January, but the weather was very severe during these two months.

We have been particular in giving herring and smelts a good chance to spawn. We not only allow them the days the lease requires but give them the whole month of May, which is their best spawning month.

Again, under date of Nov. 20, 1874, Mr. Look reports as follows: —

We have not put any new kinds of fish in the pond since my last report. We have removed from the pond 12 barrels of white perch, some 200 barrels of herring and about 10 barrels of smelts. Net proceeds, $485.20; town's part $24.60.

You will perceive that the catch was smaller than last year, not owing, however, to the scarcity of fish. We selected out some 12 barrels of the largest perch and let them go as breeders; also released all the smallest sized fish, which were very numerous.

Herring [alewives] were very numerous, but in consequence of the dullness of the market we caught but a very small proportion of what were in the pond. I should say that there were certainly 600 barrels of herring left to spawn. They were about one-sixth larger than they were a few years ago.

Smelts were not very plenty and we fished but a very little for them. I noticed that there was an abundance of smelt spawn attached to the pebbles and grass in the streams, where they deposited their eggs during the month of April. I saw also a large number of smelts passing from the pond to the sea about the middle of April. I caught some of them and found that they had spawned.

On Oct. 18, 1875, Mr. Look wrote that the net proceeds of the fishery of the pond during the year were $1,015.31, of which the town's part was $50.71. He said: —

This amount was mostly for herring, which were very plenty.

There were no perch removed from the pond during the year; the lessees thought it better to let them spawn one year, although they are quite numerous.

Last spring, while seining for herring, we caught some 5,000 or 6,000 pounds of large white perch at one time; we picked out a few of the herring and tipped the seine and let the perch go. The pond seems to be well stocked with perch of all sizes.

Smelts were very numerous last spring, but owing to the hardness of the winter it was impossible to fish for them until the season for catching them was about up. We caught some 15 barrels. There was a swarm of smelts in the fresh streams during the spawning season, — more than has been seen for four years. The pebbles in the stream were covered with spawn.

The last report from Mr. Look appearing in the commissioners' report is a brief statement of the number of fish caught, dated Dec. 31, 1883: —

White perch, 5,800; alewives, 89,731; striped bass, 8; smelts, 126,800; tautog, 57.

Regarding shellfish, Mr. Edwards says that the "soft clam" (*Mya arenaria*) is fairly abundant. Hard clams, or "quahogs" (*Venus mercenaria*), apparently never existed there, as no old or dead shells have ever been seen. It is said that oysters abounded up to 1825. That year the pond remained closed throughout the season, and in August the water became hot and stagnant, killing all the oysters. Mr. Look and sons have planted some in the last few years, but they have not done well.

The number of species of fishes occurring in the pond varies with the seasons, as elsewhere, so that sometimes there are but few taken; the same may be said of the quantity of any kind. Such was the case in 1907 and 1908, according to Mr. Edwards, but the reverse obtained in 1906.

On October 5 and 6, and on the 16th to the 19th, both inclusive, Mr. Edwards made 10 hauls of the seine each day, or 60 hauls in all, at the upper end of the pond, taking on those days, respectively, 38, 34, 36, 35, 34 and 39 species. On the 20th he made 15 hauls near the outlet, taking 46 species, collecting in all 79 species. Eleven were recorded by Mr. Edwards as "numerous" or "many," all but 3 of which were found quite generally distributed, but varying greatly in numbers in the different seine hauls.

At the upper end of the pond 24 species were taken that he did not find at the lower end. Nine species were found exclusively at the lower end, but of 7 of these there was only 1 each and only 5 each of the other 2 species. While most of the 24 kinds found at the upper end of the pond were rather scarce, they usually exceeded in numbers those found only at the lower end. Three of them, *Lucania parva, Fundulus diaphanus* and *Menidia berylina cerea,* were among the most abundant fishes of the pond, and naturally occurred in the more brackish water.

Of the species listed some are adventitious forms already recorded by Dr. H. M. Smith from Woods Hole and vicinity, principally at Katama Bay, Martha's Vineyard, not far east from Tisbury Great Pond. But there were collected 3 species not previously recorded from localities so far north; these are *Gymnachirus nudus* Kaup, *Platophrys ocellatus* and *Gobius stigmaticus.*

A few hauls of the seine were again made on November 13 to 15, both inclusive, in which only 35 species were caught, but adding 6 to the pond list.

The following is a revised and annotated list of 85 species of fishes

of Tisbury Great Pond, prepared from the list furnished by Mr. Edwards and arranged according to the order in Jordan & Evermann's "Fishes of North and Middle America:" —

1. *Mustelus canis* (Mitchill). "Smooth dogfish." Listed by Edwards without further data.
2. *Raja erinacea* (Mitchill). "Summer skate." But 4 taken, 2 at the upper end and 2 at the lower end of the pond.
3. *Anguilla chrisypa* (Rafinesque). Eel. Plentiful at both parts of the pond.
4. *Elops saurus* (Linnæus). "Big-eye herring." On the 16th 4 were taken at the upper end and on the 20th 1 at the lower end of the pond.
5. *Etrumeus teres* (DeKay). Round herring. Six collected on the 19th at the upper end of the pond.
6. *Clupea harengus* (Linnæus). Herring. Quite evenly distributed; 72 caught.
7. *Pomolobus pseudoharengus* (Wilson). Alewife; "herring." Pretty evenly distributed; more common than the glut herring; one of the abundant species.
8. *Pomolobus æstivalis* (Mitchill). Glut herring. Many were take in one haul and a few in another on October 19 at the upper end of the pond, but at no other time.
9. *Brevoortia tyrannus* (Latrobe). Menhaden. Young very numerous and commonly distributed in the pond; taken in both months.
10. *Anchovia brownii* (Gmelin). Striped anchovy. Only 3 taken, on the 5th at upper end of the pond.
11. *Anchovia mitchilli* (Cuvier & Valenciennes). Common anchovy. But 8 taken, on the 19th at upper end of the pond.
12. *Salvelinus fontinalis* (Mitchill). Brook trout. Listed by Edwards without further data.
13. *Osmerus mordax* (Mitchill). Smelt. Some smelts were taken every day at both ends of the pond; 215 in all.
14. *Synodus fœtens* (Linnæus). Lizard fish. One was taken near the outlet on the 20th.
15. *Fundulus majalis* (Walbaum). Killifish. This species seemed not to be very numerous; only 45 were collected, and all at the upper end of the pond.
16. *Fundulus heteroclitus* (Linnæus). Mummichog. Abundant everywhere.
17. *Fundulus diaphanus* (Le Sueur). "Spring minnow." Pretty numerous at the upper end of the pond, none taken at the lower end.
18. *Lucania parva* (Baird & Girard). "Rainwater fish." First recorded from the Woods Hole region by Dr. Smith in 1898. In this pond it was caught only at the upper end. It was very abundant in some hauls, scarce in others.
19. *Cyprinodon variegatus* (Lacépède). "Short minnow." Over 90 were taken at both ends of the pond, but they were somewhat more numerous at the lower end than at the upper end.
20. *Tylosurus marinus* (Walbaum). Garfish. Nineteen collected, all but 1 at the upper end of the pond.

21. *Hyporhamphus roberti* (Cuvier & Valenciennes). Halfbeak. Listed by Edwards without further data.
22. *Pungitius pungitius* (Linnæus). Nine-spined stickleback. Only 1 was taken in October, that at the upper end of the pond on the 19th; others were found in November.
23. *Gasterosteus aculeatus* (Linnæus). Three-spined stickleback. Only 16 taken, found at both ends of the pond.
24. *Apeltes quadracus* (Mitchill). Four-spined stickleback. Abundant at both ends of the pond.
25. *Fistularia tabaccaria* (Linnæus). Trumpet fish. Only 1 caught, at the upper end of the pond.
26. *Syngnathus fuscus* (Storer). Pipefish. Numerous everywhere.
27. *Menidia berylina cerea* Kendall. "Little silverside." Found common at the upper end of the pond; none observed at the lower end.
28. *Menidia menidia notata* (Mitchill). Silverside. Abundant everywhere; large individuals of this species are probably the "green smelt" of the fishermen of this locality.
29. *Mugil cephalus* (Linnæus). Striped mullet. Many everywhere; none mentioned in Mr. Edwards' November list.
30. *Mugil curema.* White mullet. Listed by Edwards without further data.
31. *Sphyræna borealis* (DeKay). Barracuda. Twenty were taken, 11 at the lower end of the pond in October; none in November.
32. *Ammodytes americanus* (DeKay). Sand eel. Collected only in November. Large ones listed as *A. dubius.*
33. *Scomber scombrus* (Linnæus). Mackerel. At the lower end of the pond 5 mackerel were taken on October 20, and others in November.
34. *Decapterus macarellus* (Cuvier & Valenciennes). Mackerel scad. Five taken at the lower end of the pond on October 20; none in November.
35. *Trachurops crumenophthalmus* (Bloch). Big-eye scad. There were 20 specimens collected, 14 in one day at the upper end of the pond; none found in November.
36. *Carangus hippos* (Linnæus). "Horse crevalle." Sixty-three collected at both ends of the pond.
37. *Carangus crysos* (Mitchill). Yellow crevalle. Only 16 caught, 11 at the lower end on October 20; none in November.
38. *Vomer setipinnis* (Mitchill). Horsefish. One collected on October 20 at the lower end of the pond.
39. *Selene vomer* (Linnæus). Look down. According to Dr. Smith this fish is rare in this region; first noticed in 1885; usually taken in September.
40. *Trachinotus falcatus* (Linnæus). Round pompano. In the upper end of the pond 12 were taken in October.
41. *Trachinotus carolinus* (Linnæus). Pompano. Only 8 taken, all at the upper end of the pond and 6 of them on the 19th of October; none in November.
42. *Pomatomus saltatrix* (Linnæus). Bluefish. All that were collected were found at the upper end of the pond; 84 were caught, 38 of which were taken on October 4 and 41 on the 5th.

43. *Poronotus triacanthus* (Peck). Butter fish. Four were caught in October, 1 of which was at the lower end of the pond; others were collected in November.
44. *Morone americana* (Gmelin). White perch. Very common; 208 taken, 74 in one day at the upper end of the pond.
45. *Epinephelus niveatus* (Cuvier & Valenciennes). Snowy grouper. But 1 taken, this near the outlet on October 20. This is one of the southern strays.
46. *Centropristes striatus* (Linnæus). Sea bass. Fifty-one were taken, probably all small, only 1 of which was at the lower end of the pond.
47. *Priacanthus arenatus* (Cuvier & Valenciennes). Short big-eye. Four specimens were secured, 2 on October 16 at the upper end and 2 on the 20th at the lower end of the pond.
48. *Lutianus griseus* (Linnæus). Gray snapper. First recorded by Dr. H. M. Smith in 1898; two specimens of young about 1½ inches long found here on October 17.
49. *Lutianus apodus* (Walbaum). Schoolmaster. First recorded by Smith in 1898; 2 found here on October 17 at the upper end of the pond.
50. *Stenotomus chrysops* (Linnæus). Scup. Forty-one collected; 26 in one day at the upper end of the pond; none taken in November.
51. *Lagodon rhomboides* (Linnæus). Sailor's choice. Reported by Smith as not very common, but they were very numerous in this pond; said by Edwards to be more common than the scup. At the upper end of the pond 117 were taken, 72 of which were on October 4 and 33 on the 5th; none at the lower end; others taken in November. Mr. Edwards said they were about 5 inches long; much brighter color than elsewhere in the region.
52. *Kyphosus sectatrix* (Linnæus). "Rudderfish." One specimen only was taken, at the lower end of the pond on October 20.
53. *Cynoscion regalis* (Bloch & Schneider). "Squeteague." All taken at the upper end of the pond, 11 of the 16 on October 18; none in November.
54. *Leiostomus xanthurus* (Lacépède). Spot. Only 4 taken, 1 on each day from October 17 to 20 inclusive.
55. *Menticirrhus saxatilis* (Bloch & Schneider). "Kingfish." Only 7 kingfish, all at the upper end of the pond.
56. *Tautogolabrus adspersus* (Walbaum). Cunner. Small cunners were found everywhere; 169 taken in all, from 24 to 31 each day.
57. *Tautoga onitis* (Linnæus). "Tautog." The tautog seemed to be pretty common; 142 in all were collected, from 16 to 31 each day, most at the lower end of the pond.
58. *Chætodipterus faber* (Broussonet). "Angelfish." Smith says that this species is a very rare straggler, first taken in 1889, since when only 3 have been observed; all taken at Menemsha Bight, Martha's Vineyard. One specimen about 2$\frac{5}{16}$ inches long was taken on October 4 in this pond near the upper end.
59. *Chætodon ocellatus* (Bloch). Butterfly fish. Four specimens were taken, 3 at the upper end and 1 at the lower end of the pond.

60. *Monacanthus hispidus* (Mitchill). "Filefish." First recorded by Smith in 1898. Found here quite plentiful; 83 were secured in October and still others in November.
61. *Alutera schœpfii* (Walbaum). "Foolfish." Seven specimens were taken at the upper end of the pond.
62. *Sphæroides maculatus* (Bloch & Schneider). "Puffer." Eight were obtained, found at both ends of the pond.
63. *Chilomycterus schœpfi* (Walbaum). "Porcupine fish." Said by Smith to be rare and irregular of occurrence. It was taken in this pond only in November.
64. *Myoxocephalus æneus* (Mitchill). "Little sculpin." Nineteen specimens were collected in October, the most at the upper end of the pond; others were taken in November.
65. *Myoxocephalus octodecimspinosus* (Mitchill). Sculpin. This species occurs only in Edwards' November list.
66. *Gobiosoma bosci* (Lacépède). Naked goby. Listed by Edwards without further data.
67. *Gobius stigmaticus* (Poey). According to Jordan & Evermann the recorded range of this species is coast of North Carolina, the West Indies and northward to Rio Janeiro. One specimen about 1¼ inches long was taken in this pond on October 20. This is the first record of this fish known to the writer north of North Carolina.
68. *Opsanus tau* (Linnæus). Toadfish. This species seems to be common; 142 were collected in October, taken in all parts of the pond; also taken in November.
69. *Pholis gunnellus* (Linnæus). Rock eel. Only 6 specimens taken, at the upper end of the pond.
70. *Prionotus carolinus* (Linnæus). Sea robin. Eight were taken, occurring at both ends of the pond.
71. *Prionotus strigatus* (Cuvier). Striped sea robin. Thirteen were collected, all at the upper end of the pond, of which 11 were taken on October 4.
72. *Zoarces anguillaris* (Peck). Mutton fish. One was taken near the outlet on October 20.
73. *Merluccius bilinearis* (Mitchill). "Whiting." This species was taken only in November.
74. *Pollachius virens* (Linnæus). Pollack. Taken only in November by Edwards.
75. *Microgadus tomcod* (Walbaum). Tomcod. This species was pretty common in all parts of the pond, but the most were taken near the outlet on October 20.
76. *Gadus callarias* (Linnæus). Cod. Recorded by Edwards only in November.
77. *Urophycis tenuis* (Mitchill). Hake. Reported only in November by Edwards.
78. *Urophycis chuss* (Walbaum). Squirrel hake. Mr. Edwards reported 16 of this species taken in various parts of the pond in October, but none in November.

79. *Paralichthys dentatus* (Linnæus). "Summer flounder." Only 6 of this species taken in October, all at the upper end of the pond; again listed in November.
80. *Paralichthys oblongus* (Mitchill). Four-spot flounder. Apparently not numerous.
81. *Pseudopleuronectes americanus* (Walbaum). "Winter flounder;" "flat fish." Abundant everywhere both in October and November.
82. *Lophopsetta maculata* (Mitchill). "Sand dab." In October 60 were taken, 35 of which we caught at the outlet on the 20th; others were obtained in November.
83. *Platophrys ocellatus* (Agassiz). Specimens about 2½ inches long were caught on October 4 at the upper end of the pond; others were taken October 16 and 20. Jordan & Evermann give the range of this species, "Western Atlantic from Long Island to Rio Janeiro, on sandy shores." The only other record of its occurrence north of Florida seems to be that of Bean, who collected 2 small examples at Fire Island Inlet Beach, Great South Bay, Long Island, Sept. 30, 1890.
84. *Achirus fasciatus* (Lacépède). Hog choker. Only 9 of this species taken, all on October 5 at the upper end of the pond.
85. *Gymnachirus nudus* (Kaup). Naked sole. One specimen taken on October 20 near the outlet. The only previous record of this species is the original one of Kaup,[1] who, in 1858, under the name *Gymnachirus nudus,* described a scaleless sole from Bahia, Brazil, making it the type of a new genus.

The report of Arthur Merrill, superintendent of the Sutton hatchery, follows: —

To the Commissioners on Fisheries and Game.

I herewith submit a report on fish-cultural work and general improvements at the Sutton hatchery.

At the end of 1909 the collection of eggs for hatching the present year was very satisfactory, the number being nearly 900,000, — the largest amount ever secured here. They were of superior quality, fertilization being unusually good. There was no loss traceable to diseased ovaries, which sometimes has a noticeable effect on the quality of the eggs.

There were 610,000 eggs taken from the adult trout in the large pond, — only a moderate number for the stock of fish in the pond, owing to an excess of males; 150,000 eggs were collected from yearling fish, a smaller number than usual because of the smaller spawners. The brown trout yielded 130,000 eggs, an increase over 57,000 taken the previous year, made possible by using the pool below the dam to increase the

[1] Uebersicht der Soleinæ der vierten subfamilie der Pleuronectidæ (Weigenmann Archiv für Naturgeschichte, I, p. 101, 1858).

stock of breeders. The brown trout in this pool do not yield as heavily as the plumper ones in the pond, but their eggs are fully as good.

At the end of the spawning season the surplus males were sorted out, and nearly 1,100 were liberated in suitable lakes and rivers. The yearling spawners were wintered in the upper pond, and were put in the main pond the next spring, when two years old, but being small the loss from cannibalism was rather heavy. This loss has been an annual experience, but it seems unavoidable when it is necessary to mix two-year-old fish with larger ones, although when the runway system below the dam is completed it may be possible to grade the fish so that the loss will be much reduced.

No eggs were sent away during the winter, and the increased number taken made the number for hatching nearly twice what is usually retained, while the water supply remained the same, and at the time of greatest need, when the embryos were developing, just previous to hatching, was only 1 gallon per minute for 200,000 eggs. The normal flow sought for in hatchery construction is 1 gallon per minute for 25,000 eggs.

As the eggs developed and required an increasing supply of oxygen, the effect of this scanty flow was to partially suffocate them, in the lower troughs even to kill them outright, large numbers showing the dead trunk of the embryo in the otherwise normal appearing egg, diagnostic of suffocation. The loss of fertilized eggs was very heavy up to the time of hatching, after which, while the fry subsisted on the yolk sac, which is the easiest period of their existence, nothing unusual happened except an outbreak of gill inflammation, which was easily checked by the use of salt. But at the beginning of the period of feeding and growth there was a widespread development of "weakness," and in all the ponds and troughs, without exception, heavy losses followed, ultimately reducing by 50 per cent. the stock of fingerlings reared from the number the year before. The rearing troughs, which normally carry an excess of fry to restock the ponds and distribute advanced fry in June, were so depleted that the use of half of them was discontinued.

No such widely extended loss of fry ever occurred before, and it can only be assumed that it was brought on by an overcrowded hatchery.

An account of the development of this hatchery and its water supply has been given before, and the deficiencies that make it dangerous and unsatisfactory were pointed out, with recommendations for improvement. These recommendations, which are repeated, are, in effect, that the present building be given up, as it is in such a state of decay that repairs to keep it in existence would be wholly disproportionate to any value that it can have. It is unsafe for hatching, as in every year of its operation incipient cases of fry disease have appeared. —

several times causing heavy losses, — which might at any time lead to an extensive epidemic.

Brown trout fry to the number of 60,000 were distributed in rivers suitable for them, and 400,000 brook trout fry were put in brooks. The rest of the brook trout were reserved for rearing, and under normal conditions would have been sufficient for filling all the ponds and distributing 50,000 to 75,000 advanced fry in addition, but this expected distribution was not carried out, owing to the loss of the fry intended for it. The brown trout fry did better than the brook trout fry in the upper rearing troughs, but in such cold water they never make a satisfactory growth. In the lower ponds, where the brook trout cannot live, the results with brown trout were comparable to the results with brook trout in the spring-fed ponds.

The health and growth of all the trout were very satisfactory after the feeble ones had been eliminated, the only further loss occurring in the west ponds, where the same trouble often happens, and in this case was due to long-delayed distribution. The number of fingerlings raised and distributed was 76,000, — 12,000 brown trout and 64,000 brook trout.

Some work of improvement was accomplished, being limited to what could be done permanently. On the brook the work of concreting was extended up by the hatchery, the whole forming a very useful runway for the yearling spawners. As a harder bottom was reached the newer part was of solid concrete instead of concrete slabs. At the point where the change was made a concrete arch bridge was built across the brook. The continuation of this work was planned so as to replace the decayed wooden pens that extend up to the dam, and in the other way, with a concrete channel that would also serve as a runway where the waste water from the dam flows down.

For the purpose of developing a new water supply that could be used in the present building or in the new hatchery, the area to the south of the brook, in the large hare pen, containing a great number of small springs, was ditched, the mud thrown into banks and covered with gravel, 400 feet of field tile laid, the joints covered with screened pebbles, and the whole graded over with gravel. The water was conducted into a concrete settling tank, with underdrain for cleaning, and a 4-inch vitrified pipe, with cemented joints, laid to the old hatchery pipe at the quail pens. This pipe will be laid through the pens, when they can be emptied of birds for the purpose of doing the work, to the site for the new hatchery. At the upper end of the collecting drain a connection was made with the brook, which here receives its main supply from near-by springs, and an additional supply provided for in seasons of low water.

The barn was raised 16 inches and brick underpinning laid on three sides, wood and concrete being used on the fourth. This work increased

the head room, which before was insufficient for any person to stand erect, so that the whole could be used for work or storage, and made it practicable to make a concrete manure pit and floor, so that the last difficult hiding place of rats was destroyed.

Some attention has been given to the grounds each year in making general improvements, and this was continued, including considerable tree and brush cutting, grading where work was done on the ponds, seeding and propagating beds for shrubs desired in bird work, and blowing out stumps and grubbing to get more open ground. Large quantities of loam used in bird pens were utilized in grading the brooder ground along the road at the barn, and on the terraces at the pond.

To the recommendation made for improvements for hatching, needed on account of the unfitness of the present building for that work, it might be added that proper facilities for handling, sorting and penning up fish, incidental to the work of spawning and shipping, are also needed. At present this is done without any conveniences planned for the work, and from lack of protection in inclement weather is subject to interruptions and serious delays.

These improvements, if carried out as suggested, would provide that all this work would be done at one place, with equipment adapted for the work. In addition, the opportunity would be given to carry on some desirable experimental work, also to co-operate most advantageously in studies of fish and fish diseases.

The recommendation for a road owned and controlled or fenced by the State, that has been made several times, is repeated, for the need of this improvement seems more urgent than ever to end a condition which is not very creditable. Passage to or from the grounds is inconvenient on account of obstructions and detours, dangerous at times on account of the cattle and sometimes bulls, and unduly expensive in the time spent in keeping a clear passage through the field when this is necessary.

The plank pens below the dam, seven in number, are in various stages of decay, some being so nearly rotted out that they are of little further use and of such small value that they might well be discontinued; but those lying below, and receiving the overflow from the dam, are useful for rearing, and very necessary for handling the spawners that are run into it when the pond is drawn off. Concrete could be easily put in as there is an ample filling of stone and gravel to build on. Building narrower pens in pairs, getting six in place of the present three, would give more useful pens, and the extra ones would replace the three north of the hatchery, that could be filled in instead of being rebuilt. The work of rebuilding these pens would include the enlarging and concreting of the pool below the dam, that is so useful for holding the breeding brown trout. For the channel to carry the waste water and

serve as a runway for yearlings, the concrete slabs that are in use, with entire satisfaction, farther down the brook are recommended, with a heavier slab to cover and hold them in place, instead of the chestnut frame used down the brook.

The water supply for the house is at present very uncertain, because the hydraulic ram pumping it is worn out and gives a small and interrupted supply. The supply was never satisfactory because, being drawn from the pond after being used for fingerling and brood fish rearing, it was unfit for culinary purposes and for drinking. The expense of maintenance has always been excessive because the water carries, as a heavy sediment, the mud of the ponds stirred up by the fish, and this by constantly clogging the pipes and deranging the working of the ram required frequent cleaning and repairs. With the improvement in the hatchery carried out, an opportunity would be given to replace the ram with a pumping engine or motor, and substitute the water used in the hatchery for the unfit pond water.

A cook house, for use both in fish and bird work, is very desirable, as with it changes in the details of feeding could be carried out that would make possible the use of less expensive material, and substitute cooked for the less safe raw food. Such a house appears to be an inseparable part of the equipment where any extensive bird work is carried on, and is a valuable aid in preparing food for fish, especially in seasons when there is a scarcity of meat.

Except for the permanent improvements on the buildings, ponds and grounds, the relative importance of the work on fish or birds, as measured by the cost of supplies and attention given, indicates that the operation of the fish hatchery requires not more than two-fifths of the whole, which for the present year was about $4,600. The cost of the improvements is estimated at $900, the most important items being $80 for the refrigerator, $115 for the work on the barn, $135 for the new water supply, and $270 for the concrete work along the brook. The labor and miscellaneous supplies cannot be exactly apportioned, but while it is known that the greater part of the teaming and carting was on fish account, the greater part of the labor, lumber, hardware, oil and food was for the birds, amounting, for the food alone, to $500 for grain and meat for the birds and $250 for fish meat.

A division of labor cost is more difficult, for hardly two days are alike, but the hours generally run with an excess given to the birds, especially in the season of the greatest amount of work.

The estimate of three-fifths of the expense for bird work, which is approximately correct, would, if applied to the cost of routine work, make the cost of rearing birds $2,400, and the cost of fish $1,600, excepting only the principal items of permanent work.

The cost of labor is increased by the eight-hour day law, and, as has been reported before, this is greater than the difference between ten

and eight, for the day's work cannot be compressed into eight hours, running, as it does, through a considerable part of the year to ten, twelve or fifteen hours, and the supply of labor sufficient to accomplish what is needed to be done cannot be economically spread over a day of that length, even if it can be furnished.

Changing conditions have increased the average cost of labor to 24 cents per hour, and it is still necessary to do with temporary day labor much of the work that will only yield the best results when done with a considerable degree of skill and intelligence.

With the increase of the present work that is expected, and the added problem of doing experimental work in breeding ducks and the European gray partridge, it is an opportune time to seek a class of assistants who will regard highly the privilege of study and observation that goes with the work, and will work with the aim of contributing all they can to the success of the undertaking.

Respectfully submitted,

ARTHUR MERRILL.

Distribution of Fish and Eggs during 1910.

Fry distributed,	925,000
Fingerlings distributed,	133,500
Adult fish put out (white perch),	1,717
Brooks stocked with fry,	151
Applications filled for fry,	163
Brooks stocked with fingerlings,	217
Applications filled for fingerlings,	317
Great ponds stocked during the year,	16
Rivers stocked during the year,	1

Hatchery Expenses.

Adams,	$316 20
Hadley,[1]	371 20
Sutton,[2]	5,930 67
	$6,618 07

GAME BIRDS.

Some of the important facts elicited by our biological experiments and observations incidental to rearing and liberating bob-white may perhaps throw some light upon some causes of disappointing results in the numerous attempts made by sportsmen's associations and individuals to restock depleted covers.

[1] Includes purchase of 200,000 trout eggs at 50 cents per thousand, $100.

[2] Includes purchase of 60,000 trout fingerlings at $15 per thousand, $900, and cost of rearing pheasants and quail.

The most significant cause of ill success appears to be due to lack of knowledge of the importance of the family ties in this species. The family flocks keep together until the approach of the breeding season. We have repeatedly observed that a bird from another flock was received into full membership in the family only after much strife, in some cases resulting in the death of the stranger. In cases where, for example, two flocks were put into the same box for transportation to the place of liberation, the flocks quickly assort themselves when freed, and seek separate feeding grounds. Birds from different flocks usually do not unite into one flock, but wander apart, seeking their old covey companions.

Apply these facts to conditions which obtain in cases where quail are purchased for liberation in large quantities. Ordinarily they are trapped by boys or negroes in the south, a small number being taken from different flocks. These are then taken to the country store, where they are confined with birds similarly taken in different parts of the country. The original flocks are hopelessly mixed. They are taken north and liberated, either in the autumn or long before the mating season. The birds, then, thus liberated, wander off, each seeking its original flock companions. The chances of these birds uniting into coveys of reasonable size are very remote. If they do not so unite the chances with enemies are exceedingly small. We have noted that in instances where a covey was harassed by a cat or a fox the neighborhood of the roosting place was changed nightly, whereas if they were undisturbed they chose the same roosting place repeatedly. The peculiar and well-known manner in which the bob-whites arrange themselves is a great safeguard against prowling enemies, and the safety of any one individual is enormously increased in proportion to the increased size of the flock.

A further complication arises as a result of the temporary confinement of the birds in old chicken coops. Here they are exposed to infection from the parasites, both animal and vegetable, so frequent in domestic poultry, but to the effects of which domestic poultry is relatively immune. Then follow the diseases peculiarly fatal to bob-white, and known under various names, coccidiosis, "blackhead," white diarrhœa, Alabama

quail disease, etc. As a result of long confinement may follow lung diseases (either inflammatory or fungoid), digestive or excretory derangements.

The obvious remedy for these untoward conditions is artificial propagation, with the necessary precautions to grow healthy stock and prevent the spread of infectious diseases.

The report of Superintendent Merrill of the Sutton hatchery follows: —

To the Commissioners on Fisheries and Game.

GENTLEMEN: — I herewith submit a report on rearing game birds at the Sutton hatchery for 1910.

This work, which has been carried on with an increasing degree of success, was continued on the same lines as was followed the previous year. We have improved methods where opportunity offered, but are experimenting for the purpose of finding a way to do a far more extended work, with the proper methods so far worked out that the waste in time and expense will be the least possible.

The season's work has shown a most marked advance in the details that have been previously open to question. For some troublesome difficulties, as is the case in all pioneering work, easy solutions have been found; others must be left for future work, with the weight of added experience in favor of a practical solution. Some details of a local nature, relating to the mating, care or hatching of the birds, and constructing coops, have been changed and improved; for others, relating to the scope of the work, more definite recommendations for changes and improvements can be made. On the whole, the results, while quite satisfactory from a practical point of view, are much more valuable in the application of the experience gained in doing more effective work in the future.

A lesson of the season of 1909, near the end of the year, emphasized a difficulty in working with quail that was not fully appreciated before, but which is of such importance that its solution is probably the key to the domestication of the quail. The growth of the young in confinement was very encouraging, but they did not develop the vigor to carry them through to maturity, and when, as in the case of the late summer lots, cold weather overtook them when not fully grown, they became rather easy victims to organic or functional diseases, and even the older lots did not possess strength to carry them through the winter without some loss from lung congestion and nephritis ("bird gout").

The conditions that caused this winter loss undoubtedly affected the breeding lots during the following summer, causing much more loss during the season that they were in breeding pens, and interfering with the gain in prolificness expected from domestication.

The average number of eggs laid was about the same to each bird, a little above 50, but the largest number to a bird was only 84, as compared with 102 last year and 100 the year before. However, several of the most promising layers were lost by death or escape before the season was over.

In the matings the descendants of the hen that in 1908 laid 100 eggs, and the other that in 1909 laid 102 eggs, predominated, largely for the reason that the birds so descended did not suffer the winter losses that the others did, either because they hatched earlier or possessed a greater degree of inherited vigor. The better-laying hens come from these lots and from the old hens left over, but no particular distinction could be noted in the fertilization. In a series of four pens, the birds on both sides being the second generation from the 100-egg bird of 1908, the earlier broods showed exceptional vigor, and the succeeding ones were hatched and reared separately, each comparing favorably with the other lots hatched at the same time, and especially with those that were of more mixed blood or had an infusion of wild blood.

This strain of birds, the longest grown and maintained, was of noticeable tameness, and this was secured without effort to a degree that had been found impossible in the earlier years. In contrast with these the progeny of 4 birds with wild mates were most difficult to tame. Though grown under the same conditions, and given close attention to tame and better fit them for pen breeding, as they were desired for future brood stock, their inherited wildness was manifest, however handled.

The wild birds, though supposed to be of native stock, did not differ materially in size or markings from the pen-grown stock of southern or western extraction. Three of the 4 were hens, and proved fine examples of the adaptability of quail to breeding in captivity. The full number of eggs laid by each could not be credited, owing to the raids of squirrels, they taking some eggs from all the pens, but pen 33 yielded 25 eggs; pen 34, 45 eggs; pen 35, 34 eggs. In all the pens they attempted incubation, but this could not be allowed, as their situation was quite hopeless for rearing young. In pen 34 the hen first attempted to incubate 11 eggs; these were taken away, and in nineteen days she laid and started to incubate 13 more. The wild male was mated with a bird that laid 67 eggs, 65 fertile.

Only 1 female failed to lay, and this failure was probably due to an enfeebled condition, as she died during the summer, much emaciated. Two females died in extruding their first eggs, the only cases of this kind in bird work here.

Fertilization was uniformly good, with one exception, viz., lot 9. Because of some abnormal condition only 33 of the 40 eggs were fertile.

Incubators were used only to finish eggs partly incubated by bantams, but, as several lots so hatched were defective, it seemed doubtful if it was of any advantage to continue, and the most of the later lots were hatched by bantams.

In the report of last year a feeble development of the embryos, causing loss in the shell or soon after hatching, was noted, and measures taken to ascertain the cause. So far as investigated, the cause seemed due in part to the influence of the setting hen on the embryos, and in part, as was shown very clearly in some cases, to the parent bird.

At the beginning of the present season a greater loss indicated that this would be a more serious problem, and some very erratic hatching, the incubation varying from twenty-two and one half to twenty-eight days, in the lots that suffered heaviest loss, rather closely connected this loss with the bantams, either in the manner of incubating or some departure from the proper temperature, airing or cooling. These matters had been under investigation, but no information resulted as to whether any methods used were at fault; and a marked variation in the body temperature of the bantam did not coincide with the varying results in the hatch; but assuming that the irregularities noted in one might in some way be connected with the other, a corrective was tried by constant and frequent changes of the bantams on the nests. They were placed in groups of 3 to 6, and daily each was taken from one nest and shifted to the next. After this was tried few lots varied from the normal time of hatching, twenty-three and one-half days, and better hatching resulted.

Another source of weakness in embryonic development was noted late in the hatching season the previous year, and to quite the same extent this year. This was determined by the record of the hatch under individual bantams, the nest being made up with eggs from two or more quail pens. It was frequently seen that in the same nest the eggs laid by one bird would hatch normally, while the eggs laid by another would all fail. This is well shown in two lots that hatched August 21. In lot 48, 7 eggs had fully developed dead embryos; these eggs came from pen 13; the other eggs, coming from pens 10 and 30, hatched strong chicks that grew up. In lot 50, 10 eggs from pen 32 failed in the same way; the eggs from pens 33, 34 and 35 hatched a lot of normal chicks.

In the case of lots 48 and 50, and others where there has been such a case of similar failure in the product of one bird, the records, so far as they are sufficient, have shown a tendency to weakness through all her progeny.

In the statement of eggs laid and infertile ones tested out, given below, the number of hens that laid the full season is 23, these laying an average of 54 eggs. The others were interrupted, in pens 22, 26 and 31, by the death of the hen before completing laying; in pen 20 the hen was killed by the male. In pens 1 and 7 the hens escaped quite early in the season. Pens 2, 3, 7, 30, 32, 33, 34 and 35 lost eggs through squirrel raids. The pens were numbered when laying began, but six have no records. In pens 4 and 6 the hens died laying their first egg. In pens 5, 23 and 25 they died early, without laying; in pen 24 they died late in the summer, without laying.

The first nest building was started by the old females in March; the first egg was laid in pen 5 by a young hen; the last eggs were laid early in September. In pen 11 the hen ceased laying in June, the earliest noted in any season.

The whole number of eggs laid was 1,384; broken in collecting, marking and handling, 15; sent away, 23; infertile, 131; broken or missing under hens, 115; fertile, but failed to hatch, 187; dead chicks under bantams or killed by them, 77; hatched apparently in normal condition and put in rearing boxes or brooders, 837.

About 140 of these chicks were deficient in strength at the time of hatching, and all quickly perished. Of the 700 that hatched in normal condition, 400 grew to the age suitable for liberation, *i.e.*, one month or over; and 171, varying in age from five weeks to five months, were liberated on reservations or land closed to hunting, where they would be cared for; 11 were liberated on the hatchery grounds, and 6 that escaped were permitted to remain with them.

The loss of birds over the age of one month was more general throughout the season, and more from incidental causes than the specific diseases that previously caused the heaviest losses. The bacillary infection accounted for the loss of 39 and nephritis (or "bird gout") for about 60, but this last loss did not parallel the loss from the same disease last year, for it came later in the season and from younger birds, — some September-hatched lots that did splendidly for the first four to six weeks, but had not sufficient hardiness to withstand the cold weather that came later.

Pen Number.[1]	Eggs laid.	Tested out, Infertile.	Pen Number.[1]	Eggs laid.	Tested out, Infertile.
1, . . .	5	5	19, . . .	48	9
2, . . .	66	14	20, . . .	29	2
3, . . .	52	1	21, . . .	42	–
7, . . .	12	–	22, . . .	45	7
8, . . .	12	4	26, . . .	28	–
9, . . .	40	33	27, . . .	45	5
10, . . .	49	3	28, . . .	83	–
11, . . .	31	3	29, . . .	37	7
12, . . .	72	7	30, . . .	71	2
13, . . .	69	4	31, . . .	33	2
14, . . .	47	2	32, . . .	67	2
15, . . .	70	1	33, . . .	25	3
16, . . .	79	8	34, . . .	45	3
17, . . .	59	2	35, . . .	34	1
18, . . .	29	1		1,324	131

[1] One pair in each pen.

Fixed methods in rearing were not considered as established by any previous work, but not much change was made this year, as the data for anything radically different were not sufficient, and it was recognized that the experimental work necessary to determine finally the maximum results that could be secured with a practical equipment and supply of labor was a greater undertaking than could be carried out with the present means; but by such incidental tests as were possible the routine was simplified, and much information gained bearing on the difficulties and failures.

Brooders were used to less than the usual extent, as early in the season less favorable results were obtained, and it was possible that the brooder was responsible; but as the season advanced and it was found that some loss apparently due to brooder troubles was actually due to more remote causes, incubators were used more successfully. The success, however, did not equal that from using bantams. These reared the best lots, and, indeed, the only ones where all the chicks hatched were brought to maturity.

This was the third year in which bantams surpassed artificial incubation, and they were used to such greater extent as to bring out some of their defects as quail rearers. Viciousness, extending to the slaughter of the quail as fast as they hatched, appeared to some extent, but the loss was kept down to a minimum by constant inspection. The attitude of the bantam was often shown before the first chick would leave the shell, the shell being torn open to kill it. In such cases the eggs could be taken away and hatched in an incubator. In two instances the chicks were accepted at first and killed later, and in another the bantam was very solicitous in hovering her chicks, only to eat them one by one at her leisure. Several cases of serious injury that seemed not to be mere viciousness, but acquired habits or tastes, resulted from feather eating. Not less than six lots, all promising, were injured, the one suffering most severely having the wing feathers torn out. The most of the others had their body feathers stripped, but their wings were untouched. In a very exceptional case the chicks, quite young, had their wings torn off. A considerable loss followed, even after the chicks were taken from the hens. Efforts made to check the practice by diverting the hen's attention were not successful, possibly because of the type of coop and shelter box used; these, although generally successful, compel the chicks to enter and leave in front of the hen, through a slatted gate that would not permit the hen to leave, and it appeared in some cases as though the habit originated in the hen's anxiety to assist the chicks to enter by seizing them by the feathers and drawing them in.

Feeding has at various times included practically all kinds of food likely to nourish young birds, but items have been eliminated until it is practically certain that a diet only sufficient in variety for a proper rotation, and not at all difficult to procure, is all that is required. The

practice of last year was continued, the food consisting mainly of maggots, sour milk, with shredded wheat, custard, and grain when they desired it. Before the end of the season the custard was discontinued, with no appreciable change in the growth or condition of the birds so fed. At times the maggots or sour milk were omitted, with no noticeable effect; and the same was true whether fed with or without fruit. These trials were not considered sufficient on which to base conclusions, as it was not possible to fully take into account the various influences that might affect the results, but they are of some value as indicating that if carried out thoroughly they would place bird rearing on a more practical basis so far as relates to procuring a proper food supply.

In the work here maggots have been regarded as the most valuable food, and with the arrangements for growing them the supply has been dependable and easily produced. In a noticeable number of cases where maggots were fed so freely that they constituted the main item of the feed, the birds thrived without any check, and it was also noted that the periods of greatest loss from bowel troubles did not coincide with feeding maggots abundantly.

The system of maggot rearing followed is to place fly-blown meat in inclined barrels, and as the maggots hatch and consume the meat to add a fresh supply, putting in dry sandy loam as freely as is required to absorb moisture and keep them covered. If the number of maggots is not large they will grow in the barrel until ready for use, when they will crawl out and drop into a box underneath. If they are crowded they will crawl out before they are grown, and can be fed in the box below. If crowded in hot weather they will heat, sometimes enough to kill them, and when hot they sweat freely, which enables them to crawl up vertical surfaces and escape. At such times dust should be used freely. When grown they are screened into another box and given a liberal supply of fresh sand for scouring, which they do by squirming unceasingly until they change into the pupa stage. It is very necessary to reserve a liberal number of maggots to change into breeding flies, and this is rendered difficult at times by the activity of the agencies that keep flies in check. At times there is an abnormal increase of a small ichneumon fly, a parasite on the meat fly, that destroys them in the pupa stage. The maggots reserved for flies must be covered up to protect them from this fly.

About midsummer a great number of black carrion bugs appear and devour the maggots. These must be guarded against by screening. Late in the summer collecting flyblows is rendered difficult by the appearance of a spotted beetle which eats them, and they are also sought by the yellow jackets which become abundant then. White-faced hornets kill and carry off many flies.

Custard, as prepared for the birds, is about in the proportion of two eggs to a pint of milk and a shredded wheat biscuit, or an equal

amount of pheasant meal or bread crumbs. This is a useful food because it is easily prepared, and it is reasonably safe if used moderately. Probably under some conditions it leads to trouble, more especially in birds of weak digestion. It is safer to use it alternately with sour milk curd, which is an excellent food, and appears, when fed, to correct the ill effects from the other foods. Sour milk mixed with shredded wheat so carefully that the shreds of the wheat are not broken is excellent for starting young birds; the two combined make the best possible food, and the birds readily eat the worm-like shreds.

As the birds (quail) grow they show more preference for hard foods, and are little inclined to eat the soft, although at any age they are fond of maggots. Grain then becomes their chief food, and should be supplemented largely by weed seed. The birds can be supplied with green food best by moving them about in portable coops, but with the approach of freezing weather the green food disappears, and with the appearance of ice and snow they have only a bleak and frozen pen, where they spend their time in inactivity, and eat what food is daily supplied them. It is difficult to keep them supplied with dust and chaff, as with the first storm this is wet and frozen, and wet chaff soon becomes a danger. It has been recognized from the first that conditions for wintering are not good, not because of the need of more warmth or protection from the weather, but because of the difficulties in feeding the birds, and the lack of any incentive to exercise. For bettering these conditions large quantities of hay, chaff and cured weeds were collected, and light portable pens constructed, closed in except a part of the sunny side, and filled with chaff and dust. Concealment was supplied by hanging loosely tied bundles of weeds in the corners, as even the tamest birds are in danger of being put in a panic by some prowling enemy or incautious visitor, and knowing a hiding place they will seek it, when without it they would dash wildly about the pen.

In wintering, the large open pens have been but little better than the smaller open ones, so it can be assumed that the pens now under trial, and very promising so far, will be much less expensive, and more easily kept in repair, than the large ones first built. Feeding will be under control, and no excess will spoil through wetting, to do future harm, while exercise can at any time be forced upon the birds by making them scratch for their food.

The diseases to which quail are susceptible were less prevalent, but not wholly avoidable, this year, owing to the continued necessity of using a very restricted area. The outlook, however, is very encouraging for raising quail with a minimum of loss from this source, and it is believed now that the much feared infectious diseases are of less consequence than organic diseases and lung or digestive troubles, the first causing considerable loss among grown or partly grown birds, the last causing the chief loss among young birds.

In 1909 a disease believed to be identical with the so-called Alabama quail disease was very destructive for a period, but its spread was checked, and the ground occupied by the infected lots treated with lime and fire. During the present season this ground was heavily coated with unused loam when a coop was placed on it, an apparently effective measure, for the appearance of the disease this year was in a different locality. First a lot of 15 birds a month old, out by the west gate, was destroyed; next, the same number of half-grown birds on the terraces by the pond. These were the only appearances of the disease west of the pond, where it was prevalent the year before.

Much later in the season, the last of September, the lot of birds reared by the male in pen 29 became infected with this disease, and was soon destroyed. Later, a lot of old birds that had been kept in breeding pens on the same ground became diseased, and died in one of the large pens, to which they had been removed for the winter, making it appear very probable that the disease in both lots had a common origin, and that in the older lot its action was much slower, or that the infection was dormant for a period.

It appears from pathological findings that this disease is the Alabama quail disease, described in Bulletin No. 109 of the United States Bureau of Animal Industry, and it is as rapid and fatal as the disease described there, for in all the lots infected not one bird has survived. The disease has spread through and destroyed a lot in less than a week, and the death of a bird usually follows in about a day from the time that its droopiness denotes that it is sick. This is particularly the case with young birds; those nearly grown and adults may live in a droopy condition two or three days. The adult birds that died in the large pen had a profuse white diarrhœa; this in the other birds was very moderate, and in the youngest very slight. In the young birds all the organs appear normal except where the intestines show the lesions characteristic of the disease, the progress of the disease being too rapid for any discoloration; but this appears in the old birds, and in them the lesions are much more numerous, appearing also on the liver, which is not generally the case with the young. There is no noticeable loss of appetite except in the case of birds that are sick the longest period, and only a moderate emaciation in these; the youngest appear as plump as when growing vigorously.

This disease is undoubtedly a poultry disease, and here evidently originates from poultry, but indirectly. In three years it has appeared in fourteen lots of birds, only five of which lots were raised under hens, and in these lots the birds were from four to seven weeks old, leading to the presumption that if the hens carried the disease it was dormant for a considerable period, or that the chicks were immune for the early weeks of their lives.

It is reasonable to expect a steadily lessening chance of outbreak of this disease with the measures taken against it, such as disinfecting

the ground with lime and fire, and abandoning the use of such places as cannot be covered with fresh loam.

The kidney disease — bird gout, which was first recognized in 1909 — has been less prevalent this year, and has been mostly confined to the younger birds hatched in September. These late lots have always been the most difficult to carry through the winter, the use of heat bringing on a chronic bowel trouble and the lack of heat resulting in much loss from lung congestion. The most successful lots were wintered in window cages, — a box with chaff inside and a roomy airing coop outside. The advantages of this arrangement, it is hoped, can be secured in the winter coops under trial.

Several lots of the older birds were moved about and brought into good condition when they showed a tendency to this disease, for its symptoms can be readily noted before there is much damage. The loss of appetite is very pronounced, and the birds move about with a characteristic stiffness which increases until they have no inclination to move, and are then found dead in an attitude of repose. The progress of the disease from the time the symptoms are noted is rather rapid, and although for a time they do not eat much, there is no noticeable loss of flesh. The kidneys vary from their normal color to reddish or yellowish brown, but are more often lighter to grayish, and frequently are quite enlarged. The ureters are filled with a chalk-like material, largely urates normally secreted by the kidneys. These urates are deposited more or less in the tissues, through the body cavity, sometimes to the extent that all the organs are covered, giving them a frosted appearance.

The conditions that would generally be approved for rearing young birds — clean quarters, a proper ration and ample exercise — are necessary to keep this disease in check. Such conditions are easily met in summer, with enough room for work, but in bad or wintry weather the matter is difficult. Here is one of the real problems in quail breeding, to which the utmost attention is being given.

The underlying consideration for producing birds that will cope with the hardships incidental to growing in close confinement is to grow them with a reserve of vigor that will carry them through any difficult period, like an enforced stay in a crowded coop, a bad storm or cold wave, a long period of wintry weather, or the trying changes of early spring. Under the most favorable conditions possible captive-grown birds must compare unfavorably with wild birds, and the deficiency of stamina makes them harder to keep than is often the case with wild birds. This deficiency is manifested in the frequent recurrence of digestive, lung and kidney troubles, a progressive increase of which is a very marked feature in the later hatched lots. The early or midsummer lots always produce the best wintering birds, the late summer or fall lots the ones most subject to the diseases mentioned, probably in part because the increasing cold of fall retards their development.

It seems very likely that, to carry these late birds through the winter, closed and partially warmed coops will be required, but there is ample reason to believe that they can be grown running free in open ground in the same way that young pheasants are reared, and, as in the case with pheasants, grow more rapidly and stronger. Fed regularly they could be depended on to seek their feeding place in bad weather, and could be recaptured if necessary. Two lots of young birds that seemed at the age of a month to be in a hopeless condition were liberated on the grounds and made a pronounced gain in vigor. They wandered out into the fields, but were back with fair regularity at their feeding places.

Some additional experience with the coccidial or amœbic disease still leaves this infection in relation to bird rearing an unsettled matter. It is certainly very fatal to grouse, producing a disease that in its spread and fatal ending is nearly as rapid as the bacillary infection in quail. In quail we have as yet no case which from post-mortem appearances, confirmed by pathological examination, could be considered to be this infection; or that has caused more than an incidental loss, taking a part of a flock, not being of the nature of an epidemic.

Among many hundred quail reared under bantams, the commonly recognized source of infection, only in four lots was the cause of death found to be the inflammation characteristic of this disease. These four lots were watched very carefully, and the highest loss in any one was 3 birds. All four were kept under observation for many weeks after the losses, and continued in the pens with all evidence of good health.

The importance of infectious diseases, as compared with other agencies, in causing loss of very young birds has never been properly estimated, being a more technical problem than could be worked out here, unless with the aid of a skilled pathologist; but among the young of the ages that have contributed most largely to the death list, no case of infection has been revealed in those submitted for pathological examination. Many died from known causes, but this is not the case of the greater number of small ones.

The character of some of the earliest losses leads to the belief that it results from causes ante-dating hatching. For the early loss is sometimes immediately after hatching, sometimes in a day or two, but is foreshadowed by the weak and stumbling movements of the birds, an abnormal number of cripples, or, as has been noted before, many dead embryos.

In one unusual case a lot of 15 birds died before they were two days old, but all became crippled immediately after hatching. Much of this loss comes before the birds take any food.

Occasionally a lot grows up with no loss; more often there is no loss after the first few weak ones, but rather frequently there is an incidental loss for which no cause has been assigned, but which appears,

from such examination as can be given here, to be an intestinal disturbance, as though it were a digestive trouble, and this loss runs most heavily in what would be called unthrifty lots. The use of lime water has been recommended and tried for this, apparently with good effect. In the case of some lots of pheasant the effect was certainly very pronounced.

Loss of the same character, and to considerable extent, is regularly met with in young pheasants reared under hens or in brooders, even when the brooders are most thoroughly sterilized, but it is far less where the chicks have unrestricted range when growing. Where this cannot be followed, improved methods, more careful attention and timely treatment, when proper treatment is known, must be looked to for lessening this loss. To know more thoroughly the extent and effect of the more important infectious and organic diseases is the most necessary step to take.

Many incidents in quail life are interesting as bearing on their domestication, and some of the difficulties encountered in their care are well worth noting.

In pen 20, after the hen had laid 29 eggs, she was found dead, with the marks characteristic of violence done by one quail to another; her head and neck behind were stripped of skin and flesh to the bone. The birds had mated and the eggs were well fertilized, 27 out of 29 being fertile, and nothing had occurred to disturb the relations of the birds except taking the eggs away. While this is believed to have excited the male to attempt incubation himself several times, no case has occurred where it has been suspected of exciting him to violence. In three other cases where the hen has been killed it was done soon after the birds were put together, and seemed to be on account of the disinclination of the hen to mate. Many more cases have occurred where a strange bird has been put in with a flock. The desire to join a flock is very strong in a lone bird, but he is not always well received, and is in much danger unless the pen is large enough for him to keep apart and establish acquaintanceship by degrees. So far it has seemed entirely safe to unite flocks of nearly equal strength; this has been tried repeatedly and no inclination to quarrel shown.

In nine instances, with a total of 102 eggs, one-fourteenth of the whole, the parent birds attempted incubation, although the opportunity was given them to incubate the greater number. In several instances they abandoned well-filled nests, the eggs left to tempt them to set, and started others. A nest with 20 eggs was so well concealed that it was not found until 14 were laid in another nest. The grass roots were attached to the oldest of the 20, and some must have lain over forty days, but only 1 was infertile and none of the fertile failed to hatch.

One female in the large pens hatched 8 very active chicks, but kept them only a few days. As in many other similar cases they quickly

disappeared, this being the invariable ending when they have been allowed the care of the young in the large pens, while they have been always successful in their care when kept in the brooder pens and the chicks fed the same as the brooder and hen reared chicks.

In four pens the eggs were taken from the parent hen when it was plainly unsafe to allow them to attempt rearing where they were kept.

Two cocks successfully incubated eggs, and in neither case was the hen seen to set on the nest. One continued to lay until the cock was covering 17 eggs, which he did very well, but after hatching his brood he escaped while being transferred, and she reared them. The cock remained about for several weeks and successively adopted several half-grown young that escaped from the pens. In the other pen the hen also continued to lay, but as the cock would not allow her near the nest, she dropped her eggs as near as she dared, and he rolled them in. His objections to her presence in the pen seemed so likely to result in violence that she was removed for safety. He hatched 11 chicks and reared all but 1 to nearly full size. This one came from one of the laid-in eggs, four days after the others.

In pen 2 a pair made an unsuccessful hatch, probably for the reason that, although the nest was in grass near the middle of the pen, it was badly infested with mites or spider lice. Both birds were removed to small brooder coops, and each given a brood of bantam-hatched chicks, which were adopted and successfully reared.

The constant menace of rats about the pens has made it necessary to wage an unceasing warfare against them. The damage that they have done has never been great, but has been such that it was seen that little could be accomplished without keeping them down, and the real burden of their presence has been in the cost of fighting them, and in the restrictions that their presence has placed upon handling the birds. Last year they killed 8 young and 15 grown birds, but took no eggs, as the breeding pens were remote from their haunts. This year no damage was done, as the warfare against them during the winter was so effective that only three were known to survive the winter.

Several years' work about the buildings and ponds in putting in concrete rat-proofing had so restricted their hiding places that those not killed by shooting, traps and poison, were killed or dislodged by the use of carbon bisulphide. At one place where their extensive runs under the pheasant pens and maple trees east of the hatchery made this ineffective, and they were disinclined to take poison, they were forced to take this by putting it in their holes and sealing the entrances with frozen mud. Others appeared in the spring, but did not become numerous or bold, or do any damage except where a lone one went to some distant pheasant coops and killed some young birds.

Early in the laying season the lessening yield of eggs, and the presence of some shells indicating that something was destroying them, led to setting traps, and in three widely separate places where eggs had

been missed squirrels were captured, — red squirrels at one place and chipmunks at all three, about a dozen in all. The loss ceased, and the yield continued at the same rate as before the interruption. Assuming that it would have been the same the whole time, the number taken must have exceeded 40.

No case of destroying eggs or young birds has been proved against mice or shrews, but they are regarded as a serious pest, as, under the protection of the pens, they multiply enormously, disturbing the birds and eating great quantities of their food. Where coops are placed on ground possibly infected, and filled with loam to safeguard the birds from this infection, the precaution is sometimes defeated by the extensive tunneling operations of the mice, where the under soil is brought to the surface.

Traps have never given satisfaction, but poison is usually quite effective, as the mice will eat it freely, even where other food is about, and they seem to have little of the caution of the rat. One peck of grain, a pint of molasses and one-eighth of an ounce of strychnine, with enough hot water for mixing, make a satisfactory mixture, and, dried after mixing, will keep to be used at convenience. For mice this is placed in dishes in any concealed place where the mice will find it, but for any open place, where safe concealment is not possible, it can be used with safety in a rainproof box in a dish or compartment in one corner, the entrance for the mice being an inch auger hole in the other corner, with many obstructions to prevent a direct passage across the box. These boxes are useful for protecting shrubbery and trees during the winter, without danger to seed-eating birds, when bird work through the summer has caused an abnormal increase of mice.

While some open-top rearing coops were being tried, a loss, small but unaccountable, was noted, when a blue jay was seen carrying off a young bird; later he took another one, and being followed was seen to eat it. Traps baited with dead birds were robbed repeatedly by him before he was finally caught.

As for the details of breeding and rearing, no specific recommendations need be made, as changes and improvements must be worked out by experience, and the best methods determined by a longer test of practice. It is suggested that these details might be quicker settled and regarded as more nearly fixed if they could be made the subject of a scientific study, with approximately the thoroughness of experiment station work.

For the expected extension of the work it is believed that nothing will prove more practical than to do it on a much larger area, where the methods of the game farm can be used; namely, to rear the birds in open ground, depending on widely extended work and use of fresh fields to secure immunity from disease. This would, of course, invite constant loss from predatory enemies, and the measure of success would depend very largely on faithfulness in guarding, but with this rea-

sonably well done the loss would hardly exceed that loss which seems inseparable from the exclusive use of pens.

The use of a small area and portable pens seems capable of accomplishing a great deal more than was hoped for in the beginning of the work. The experience of three seasons is most decidedly in favor of the small pen for breeding, and the one most likely to promote successful rearing by the parents. These small pens are very satisfactory in getting the birds to a suitable age for liberation, but beyond that the pens require an excessive amount of labor to shift and fill with loam and seed, — when it is necessary to do this, and if this is not done, disease and feebleness are invited.

If the birds are liberated young some measure of control over them should be exercised, so that care can be given if needed, and it is suggested that in addition to using public reservations, sanctuaries could readily be established in many of the deputy districts by the voluntary posting of a group of farms, so located that they would include good quail country and be under the observation of the deputy in that district, who could supervise guarding and feeding the birds when this was necessary. In whatever way this work may be provided for, it is not less important than successful rearing, and is very necessary to supplement and make that work effective.

In comparing quail rearing with other bird work, it is found that so far as it has progressed the results with quail are superior at every important point to similar work that has been done with grouse. Quail can be mated and bred far more easily, they lay more and better fertilized eggs, and their chicks have greater resisting power to the diseases to which both are subject.

Against the long-established work of pheasant breeding, only limited experience with quail can be offered, but in the two years that a fair comparison can be made, the results with both are very nearly the same. In 1909 the pheasants averaged 60 eggs, the quail 55; in 1910 the pheasants 50 eggs, the quail 54. The percentage hatched in 1909 was slightly less than 50 per cent for both; in 1910 55 per cent for pheasants and above 60 per cent for quail. To the age of one month, very soon after which either bird can be liberated, each hundred eggs yielded 22 pheasants and 25 quail in 1909; this was increased in 1910 to 27 pheasants and 30 quail from each hundred eggs.

While it is known from the work of other years that the results with pheasants can be improved, no improvement with them can be conceived that cannot readily be equalled with quail.

Experimental work was continued with grouse, confirming to some extent the conclusions previously reached, that while they can be bred and reared in captivity quite readily under certain conditions, limitations on this work, arising from their nature and susceptibility to disease, make it seem improbable that they can ever be the subject of any extensive breeding and rearing operations.

Two lots of birds from broken-up nests arrived so chilled and weak that they died almost immediately after being received. Another lot, from a nest where the old bird was killed by a dog, and a lot of eggs hatching 13 chicks from 13 eggs, gave two fine flocks that were easily grown to the age of six weeks on a diet of maggots, custard and sour milk, and at that time were in such vigor that the growth of all to maturity was more than probable.

They were brooder grown, with the usual precautions taken in sterilizing brooders and coops, and in the use of soil in the coops unexposed to infection, but being grown in proximity to other birds they became infected and quickly died from the amœbic disease. Continued success with quail lots on the same ground and in the same brooders followed, indicating that the problem with grouse, already shown to be easy in regard to food and care, should, in consideration of the danger from disease, be done wholly apart from any other bird work.

The breeding of the mature birds on hand, 1 male and 3 females, was undertaken in the quail-breeding pens without success, none of them showing any inclination to mate. The presence of the male put the females in a state of fright that they did not get over during the time they could be watched, although he was not as savage as any previously used. He was wholly indifferent to them at first, but after a time showed an inclination to attack them. Finally, when it seemed unlikely that mating would be accomplished in the small pens, all 4 birds were put in the large pen of two acres, where in a brief time 2 were found nesting. The third female remained in hiding most of the time, but if she nested her nest could not be found.

Twelve eggs in one nest failed to hatch, as all were infertile. In the other, 4 were fertile and hatched, 5 were infertile. The chicks were left to the old bird to rear, but she was not very successful, as the last one was found drowned when three weeks old. The eggs were somewhat smaller than those from wild birds, and the chicks were possibly deficient in strength, as the chick found drowned was much smaller and thinner than those of the same age in the pen-grown lots.

The work with pheasants gave about the same results as were obtained last year. The brood stock was reduced from 75 to 63 laying hens, and the eggs were proportionately less, numbering 3,300. Some obtained by exchange increased the number set to 3,650. The hatching was better, about the same number of chicks being obtained from a lesser number of eggs, the improved results being due, in part, to the more limited use of brooders. The number distributed was 696, a moderate increase over the number put out the year before, but the brood stock was largely increased in anticipation of an extension of the work, making the total number reared 770. This increase is partly owing to sending the birds away at a younger age, but does not include a considerable number that escaped when well grown and were not recaptured.

The work was necessarily done on the same ground, with nearly the same methods, brooders being used as they could be spared from other work. The majority were reared by the open-ground method with hens.

The results varied. The variation followed the season somewhat, as in most of the previous years, the early lots suffering more from cold weather. During the period through June to the middle of July the best results were obtained, because of most favorable weather conditions; following this there was an increase of digestive troubles, with additional loss because of the various enemies that were attracted by and preyed upon the young birds.

Excellent results were obtained from lots put out in the sprout land to the west, where the trees were small and scattered, the underbrush thick and the soil dry and sandy. About 500 poults were put out here, and all the successive lots grew very satisfactorily until the oldest were nearly ready to put out, when they were discovered by hawks, and it was so difficult to guard them that they were brought in. Several lots were put in the garden and shrubbery, and here the best results were obtained, for they could be easily guarded until ready for liberation, and the number kept there was not so large that they were crowded. Of several lots placed for special purposes, one lot kept a considerable area in corn free from weeds, and seemed to find the best shelter possible under the growing corn. Another lot, in a shrubbery bed, was very well sheltered under the shrubs and roses, and found an abundance of tender green food in the weeds growing in the shade, when all the fields were dry and bare. On a plot of ground not previously used for birds, on account of receiving the cleanings from the henhouses for several years, a lot was placed and given lime water freely, they also having the benefit of a rank growth of garden vegetation; this lot was in health and growth far above the average of the birds at that time. Two lots were placed in the sprout growth on the south boundary, but did not thrive, largely on account of being on a northerly slope and getting little sun, the weather being cool and cloudy when they were first put out. Here, as in the sprout land to the west, hawks gave trouble. Working under the low growth, and rarely beeing seen, they carried off many birds. To control them in such a situation some one should be on the ground practically all the time, and pole traps set about in large numbers.

All of these lots did well or fairly, none could be considered poor, and the poorest results came from being placed in a faulty situation. The watering and feeding required three to five brief visits a day; extra time was needed to treat them for lice or to watch for hawks, and occasionally to shift the coops. As compared with brooder work the labor was decidedly less, and while the percentage reared might average less, the birds were of better quality.

On account of the well-known disadvantages of working on a restricted plot of land, and the incidental injury to the other bird work

done on the same ground, it is urged that it would be practicable to do the pheasant rearing in the way that these detached lots have been cared for, but wholly in large colonies outside, and in such a scale that it would be profitable to keep an attendant constantly with the main colony, with lesser colonies within easy guarding and working distance. The season for this work would cover a period of less than four months, and the equipment required would be light and easily moved to another place for the next year's work.

The production of eggs on a large scale can be carried on with reasonable certainty of getting a stated number of good quality, and this number can easily be made to exceed the capacity of a considerable tract of land for rearing. As applied here it might be said that, without materially interfering with the largest amount of rearing that could safely be done, a surplus of many thousand eggs could be produced. These, distributed among interested parties to be hatched, reared and liberated, would largely extend the work, with a very moderate increase of equipment, while affording people who most strongly desire to have their neighboring covers stocked an opportunity to assist in the work. It does not require more than ordinary care to raise a fair percentage of pheasants, and while to do as well as this is to some extent dependent on opportunity or conditions, aptitude for the work is of most importance, and where this is shown in working with pheasants, it will be available for the more important and popular work with quail.

If the place selected for this work is free from preying enemies, or can be guarded with guns or traps, small coops to house the hen and poults for the first few days are all that are required. After the chicks learn the call of the hen they can be allowed a free run, with no danger of straying away and slight chance of any serious epidemic. Where coops are used, and they are grown in confinement, the danger from disease is far greater, and it is of the utmost importance to work on ground not used by poultry; but where this is impossible there is no more practicable way than to use a filling of untainted loam each time the coop is used.

In the present uncertain state of pheasant rearing it might not be appropriate to recommend any extension requiring costly equipment which might soon become useless for that or any other work. But if it is continued, even temporarily, and done with proper effectiveness and economy, more breeding pens must be provided to secure the desired increase of eggs and to improve their quality.

As some of the most useful quail pens were built and formerly used for pheasants, there seems to be no reason why the pens desired for pheasants cannot be built with the intention of ultimately using them for other birds.

There is a probable advantage to be gained in pens of different types, one of which, the movable, would be most useful in adapting

to other work, and is the best in many respects for breeding pheasants; another, built to cover more ground, but with open top, and used only in the breeding season for birds with clipped wings, would give the required room with less expense, and could occupy ground too rough to be used in any other way.

Besides the larger production which it will give, more pen room will make it possible to handle the birds more effectively in many ways. This year a persistent egg-eating habit reduced by many hundreds the number of eggs collected. It was corrected by putting the birds practicing it in movable coops on grass, and as a rule they quickly ceased. Feather eating, leading to the killing of several birds, was stopped in the same way. This experience and the evidence before obtained have shown that, besides saving this waste, an increased yield and better quality of eggs have resulted when the birds were given room, fresh ground to scratch and green vegetation to eat.

Respectfully submitted,

ARTHUR MERRILL.

Birds distributed during 1910.

Pheasants distributed,	696
Applications filled,	72
Quail distributed,	182

ENFORCEMENT OF LAW.

It is unfortunate that there are many people who feel that the various State boards and commissions are bound to serve exclusively the particular classes with which each comes most closely in contact. On the contrary, every commissioner, if he seeks to deal conscientiously with each problem which comes before him for consideration and decision, must primarily seek the interest of the whole State, to the complete exclusion of every special interest, geographical section or group of individuals. Too frequently membership in a secret order is used upon the commissioners or their deputies as a lever to secure special privileges or exemptions.

So far as concerns the work of this commission in its relation to the sportsmen, the conditions are peculiar. There are exceedingly wide variations between the sportsman of the best type and the opposite. The one is a conservative conservationist, the latter is a vandal in nature's temple, "a sworn foe to sense and law," whose creed is to selfishly appropriate to his own uses the fish and game to which future generations have a just claim.

Several of our laws, notably those relating to the sale of game and to the killing of "short lobsters," are impossible of enforcement in the present conditions of public sentiment. Not until actual extinction is really imminent will the persons most interested realize that the various species have not gone to some other section, to return "next year" in its former abundance, but that new conditions introduced by man (*e.g.*, forest fires, destruction and cutting of the forests, excessive killing) and new enemies (*e.g.*, cats and dogs) have been responsible in largest measure for the passing of some of our most valued species of birds, while unwise methods of capture, excessive fishing, destruction of breeding grounds and pollution of public waters have contributed to the decrease of certain fish and shellfish.

In connection with the increased number of deputies, our records indicate that there has been a decreased number of violations of the fish and game laws. Knowledge that the chances of detection are multiplied has exercised a restraining influence upon would-be violators.

Deer. — Deer have become a real problem. Economically we have large uninhabited areas well suited for producing an annual crop of these valuable food mammals; indeed, such land can produce little else. However, the utilization of this crop is a knotty problem. The average citizen doubtless would be gratified at the opportunity of an occasional glimpse of the beautiful animals. Unfortunately, however, the deer is no respecter of property rights, and while many landowners cheerfully permit the destruction of crops, fruit trees, nursery stock, etc., in exchange for the æsthetic and sentimental pleasure afforded by the presence of the deer, this pleasure proves to be a luxury too expensive for the generality of landowners and farmers. It has become a serious problem how best to reconcile the varied interests of the citizen of leisure, the farmer who must needs protect his crops and the hunter who seeks recreation in the hunt, and yet at the same time to protect from lawbreakers a valuable asset of the State. (It has been estimated that there are about 8,000 deer in the State, valued as food and hide at $25, or a total of $200,000.) Under the present law, which permits killing deer in the five western counties

except on posted land, and enables the landowner who so desires to kill deer at any time when in the act of damaging crops, about 2,000 deer were killed, or approximately 25 per cent. of the estimated total number. Under most favorable conditions the annual increase is considered to be 75 per cent. per year. Our observations indicate that the actual average rate of increase in Massachusetts has been about 40 per cent. per year. It seems, therefore, that the present law reasonably meets the conditions by providing for protection of property, for giving the landowner opportunity to indulge his tastes, by protecting the deer by posting lands, checking the undue increase of the deer, keeping them more closely confined to the wild lands, giving a limited opportunity for hunting, and safeguarding human life by prohibiting the use of rifles. The deplorable circumstances, such as permitting young children to kill, or unsportsmanlike practices which result in unnecessary suffering, can perhaps be adjusted by other means. In succeeding years we do not expect the delirious rush which characterized the first open season for twelve years. On the other hand, the excessive numbers of hunters in the rather small district insured relatively few wounded deer left at the close of the open season, and at the same time instilled a spirit of wholesome caution among the hunters. That no human lives were sacrificed in killing 1,200 deer is abundant cause for congratulation when compared with the results in Maine, Michigan and elsewhere, where rifles were legally used. Some data relative to deer in Massachusetts are included in the report of Chief Deputy Nixon.

That branch of our duties which includes the enforcement of law has been under the direct charge of our efficient chief deputy, W. W. Nixon, whose report follows: —

Boston, Mass., Jan. 1, 1911.

Commissioners on Fisheries and Game, State House, Boston, Mass.

Gentlemen: — I hereby submit my annual report for the year ending Dec. 31, 1910. I have devoted almost my entire time to office work, where I have worked early and late in my endeavors to keep in touch with the deputies of this department and to better the service.

During the year I have also collected many egg lobsters, details of which appear elsewhere in this report.

When not attending to the work of the office, mostly Saturday afternoons, Sundays and holidays, I have been about looking for illegal feathers in millinery stores, infractions of law relative to game birds, or out in the woods and covers looking for violators of the law.

The office of deputy is a difficult one to fill, and it is the duty of all good citizens to lend every assistance and encouragement. Much good has resulted from moral influence in prevention of violations, and in an educator. Much wanton destruction of fish and game can be stopped deputy who realizes the responsibility of his position can do much to bring fish and game protection into popular favor. He must become an educator. Much wanton destruction of fish and game can be stopped as well as violations of law prevented. The public are easily educated in matters of this kind, if it is put to them in the right light, and if the deputy knows the laws as he should. He should study carefully all new laws in order that he may not only understand the provisions himself, but be able to interpret the meaning to the general public. The proper observance of the fish and game laws depends almost entirely upon the vigilance and good judgment of the deputies of this department. The enforcement of the fish and game laws, however, in regard to the foreign element is about as serious a one as the deputies have to meet. This class is the most persistent and determined not only in violating the law, but in resisting arrest and attempting to evade punishment.

During the year 215 complaints have been received at the office, personally, by telephone and by letter, all of which have been referred to the deputy in whose district the violations occurred. Many arrests and convictions resulted.

A sort of census taken of the hunters on the hunting ground is a new and interesting feature in connection with the work of the deputies. This work has been carried on only a short time, but promises development. Each deputy has been furnished with cards from this office, and has been instructed, when meeting a hunter in the covers, to get his name, the number of his hunting license and the amount and kind of game in his possession, the cards to be returned to this office weekly. This information will be of marked value to the commission, as in this way the commission can keep fairly well informed of the amount and kind of game in different parts of the State, and can intelligently recommend necessary legislation, in addition to furnishing valuable statistics as to the annual production of game. The number of hunters seen on the hunting grounds, and looked over by the deputies of this department for illegal game, was 2,397. The following game was found in the possession of hunters during the open season: —

Deer,	69	Geese,	13
Coons,	2	Woodcock,	41
Monkey,	1	Squirrels,	79
Ducks,	426	Skunk,	1
Quail,	46	Teal,	1
Rabbits,	392	Partridge,	145
Wildcat,	1	Snipe,	1
Fox,	6		

I am of the opinion that the license law should be changed so as to allow nonresidents and aliens who pay for hunting licenses to shoot birds and animals of all kinds in their proper seasons, including deer, as these classes of sportsmen bear their share of the expense for fish and game protection. Also, if nonresidents are allowed to hunt deer in this Commonwealth, it would be the means of bringing in, to our rural population, a large amount of money from sportsmen of other States for teams, camp lodgings, etc.

There will always be individuals who, for their own selfish ends, will risk even heavy fines in their endeavors to violate the fish and game laws, and there are men who still regard game laws as interfering with their own peculiar ideas of freedom in a free country; still, the cause of fish and game protection goes steadily forward, and its friends have good reason to rejoice.

The commission has endeavored, by every means possible, to keep the sporting public and farmers informed as to the law regarding deer. Circular letters have been sent to all newspapers and to each nonresident holding a Massachusetts hunting license and to others interested in the new deer law.

The commission has always found the reporters and newspapers ready and willing at all times to publish matters of interest regarding the fish and game laws, and the thanks of the commission and of the general public are extended to them for the good work they have accomplished.

Bag Limit. — The bag limit should be in the interest of *bona fide* sport, and the limit of game should not be in a season but in a day, as it would be almost impossible to enforce the season limit, whereas a day limit would be relatively easy. The best hunters and all true sportsmen should be in favor of such a law, as it would be in the interest of legitimate sport.

Herring. — Numerous complaints have been made to this office of the taking of herring illegally by Italian fishermen, and many arrests have been made, convictions secured and heavy fines imposed and paid, with no let up on the part of the violators, who make their living by taking herring both outside and inside of the restricted districts. These men work hard for what small amount of money they earn, and will take the chances of arrest for a few herring.

The taking of herring for bait along the shores, and in the harbors and rivers of this State, should be given careful attention, and laws enacted that would be as just as possible to the smelt fishermen, herring fishermen and buyers. The law as it is to-day is not satisfactory to any one.

The seiners or netters, who use large seines for taking herring, sometimes catch more than their boats will hold, with the result that the surplus has to be thrown away, sometimes hundreds of barrels. If allowed to take herring by the torching method, when their boat is loaded they start for the market, and do not take more than they can handle, as they do when seining.

Assaults on Deputies. — During the year three assaults have been committed on deputies of the department, while in the performance of their duties, the most serious of which took place in Fayville, in Southborough, on July 3, at 5.30 A.M., and came near costing Deputy Bemis his life in his endeavors to arrest three Italians who were hunting on the Lord's day in violation of law. While attempting to put the handcuffs on one of the violators he was shot in the face and body by one of the others, with a charge of bird shot, some of which entered both eyes and blinded him. He was able to grope his way out of the woods to the nearest house, about a mile distant, when assistance was summoned. Every effort was made to apprehend the violators, but to no purpose. After a relentless search of ten days and nights, the matter was dropped for a time, since when no clue has been found which could be used to any purpose.

Fortunately the effects were not as serious as at first supposed, Deputy Bemis being strong and rugged, in good physical condition and used to roughing it. After careful attendance in the hospital for six weeks he is able to take up his duties again.

The assault on Deputy David, on October 7, was committed by one of two Italians whom he was arresting for violation of the game laws, and was not of so serious a nature. After being assaulted by one of the Italians and having three ribs fractured, he used force enough to land his man, who, being held in the lower court, was given nine months in jail at the Superor Court, and is now serving his time.

The case of Deputy Tribou was of minor importance. While with two other deputies, arresting a violator of the lobster law, he was held and prevented from offering any assistance to them, but the violator was arrested and fined. The party assaulting Deputy Tribou was put into court also, but was discharged.

Below is given a record of the law enforcement work of the deputies of this department, covering the past ten years. This record shows the number of arrests and amount of the fines; number of permanent and special deputies employed throughout each year; number of aliens arrested for hunting without licenses since the passage of chapter 317 of the Acts of 1905; number of nonresidents arrested since the passage

of chapter 198 of the Acts of 1907; and number of residents arrested for hunting without registration certificates since the passage of chapter 484 of the Acts of 1908. Also note the arrests for hunting on the Lord's day.

Year.	Arrests.	Fines.	Regular Deputies.	Special Deputies.			Sunday Hunting.
				Number.	Salary.	Service.	
1900,	185	$2,163 00	1	22	$20-$50	1-8 months	44
1901,	156	1,588 16	6	7	20- 60	1 month	51
1902,	157	1,772 00	10	10	20- 60	6 weeks	57
1903,	169	2,452 00	9	3	50- 60	4-6 months	41
1904,	265	4,297 00	10	14	40- 60	1-9 months	55
1905,	319	4,112 13	14	8	60	2-6 months	78
1906,	327	3,311 55	16	9	50- 60	2 months	88
1907,	390	3,599 20	14	17	60	2-6 months	69
1908,	474	7,353 75	21	18	60	1-6 months	45
1909,	421	5,774 50	23	16	10- 60	- -	52
1910,	357	3,740 00	30	14	50- 60	1 week-3 months	29

Alien arrested for hunting without license: 1905, 22; 1906, 29; 1907, 42; 1908, 30; 1909, 31; 1910, 29.
Nonresident arrested for hunting without license: 1907, 4; 1908, 1; 1909, 7; 1910, 5.
Residents of Massachusetts hunting without license: 1909, 27; 1910, 37.

Deer. — Chapter 307, Acts of 1907, allowed the farmer to shoot with a shotgun deer doing damage on cultivated land. During 1907 16 deer were shot by farmers. Under this same law, as amended in 1908, chapter 377, 17 deer were shot by farmers. This act provided that the carcass of the deer should be sold by the city or town clerk, and the proceeds forwarded to the Commissioners on Fisheries and Game.

Under this same law, as amended in 1909, chapter 396, which repealed that part of the act regarding the disposing of the carcass, since which time the farmer has retained the carcass, 198 deer were shot by farmers.

Under this same law, as amended in 1910, chapter 545, which allowed deer doing damage to be killed in any manner, 327 deer have been killed by the farmers. These figures speak plainer than words of the effect of this part of the deer law.

Below is given a summary by counties of the number of deer shot, amount of damage claimed by owner, and deputies' estimate: —

County.	Number killed.	Owners' Estimate.	Deputies' Estimate.
Barnstable,	1	$15 00	$15 00
Berkshire,	27	215 00	153 50
Bristol,	-	-	-
Dukes,	-	-	-
Essex,	2	25 00	-
Franklin,	124	1,282 40	859 15
Hampshire,	57	489 50	322 75
Hampden,	45	360 60	172 28
Middlesex,	9	51 00	12 00
Nantucket,	-	-	-
Norfolk,	8	90 00	30 00
Plymouth,	-	-	-
Suffolk,	-	-	-
Worcester,	54	289 00	124 50
	327	$2,817 50	$1,689 18

The largest number of deer doing damage shot by or under the orders of any one person was in the towns of Deerfield, Rowe, Templeton, Amherst, 6 each.

The largest number of deer shot by one person was 10, at Rowe, 6 on his own land and 4 while working for other parties.

The largest number shot in one town was Charlemont 13, Deerfield 12.

Five cases were put into court in connection with the shooting of deer doing damage, as follows: —

One case for using rifle instead of shotgun, chapter 396, Acts of 1909. Convicted; case filed.

One case for not being owner of land. Convicted; fined $25; paid.

One case where no damage was shown. Convicted; case filed.

One case of failure to notify the commission of the shooting. Convicted; fined $20; paid.

One case of not being owner of the land. Case pending, owing to illness of deputy.

Returns of the Open Season on Deer in Massachusetts, Nov. 21–26, 1910, inclusive.

Berkshire County.

	Total.	Buck.	Doe.	Wounded.
Adams,	2	1	–	–
Alford,	6	5	1	1
Becket,	20	10	8	1
Cheshire,	6	3	2	–
Dalton,	1	–	–	–
Egremont,	2	2	–	–
Florida,	14	6	6	1
Great Barrington,	6	3	3	–
Hancock,	11	7	4	–
Hinsdale,	4	3	–	–
Lanesborough,	2	2	–	–
Lee,	3	1	2	–
Lenox,	10	7	2	–
Monterey,	10	8	2	2
Mount Washington,	1	–	–	–
New Ashford,	6	5	1	–
New Marlborough,	6	3	2	–
North Adams,	5	2	3	1
Otis,	6	2	1	1
Peru,	1	–	–	–
Pittsfield,	10	6	4	–
Richmond,	5	5	–	1
Sandisfield,	10	7	1	–
Savoy,	13	6	3	–
Sheffield,	15	6	4	–
Stockbridge,	3	–	–	–
Tyringham,	3	2	–	1
Washington,	12	6	4	2
West Stockbridge,	2	1	–	–
Williamstown,	22	13	7	–
Windsor,	8	6	1	–
	225	128	61	11

Returns of the Open Season on Deer in Massachusetts, Nov. 21–26, 1910, inclusive — Continued.

Franklin County.

	Total.	Buck.	Doe.	Wounded.
Ashfield,	15	7	1	5
Bernardston,	9	8	–	1
Buckland,	23	8	5	1
Charlemont,	9	6	1	–
Colrain,	10	6	4	1
Conway,	15	6	4	–
Deerfield,	18	11	7	1
Erving,	11	5	6	1
Gill,	7	5	–	–
Greenfield,	15	10	1	[illegible]
Hawley,	8	5	2	[illegible]
Heath,	4	1	1	[illegible]
Leverett,	19	11	2	3
Leyden,	7	1	4	–
Monroe,	4	1	3	[illegible]
Montague,	19	9	5	[illegible]
New Salem,	4	1	[illegible]	[illegible]
Northfield,	16	8	5	1
Rowe,	18	12	4	[illegible]
Orange,	5	4	[illegible]	–
Shelburne,	14	7	4	–
Shutesbury,	5	2	1	[illegible]
Sunderland,	7	3	3	1
Warwick,	10	4	4	1
Wendell,	13	6	4	1
Whately,	7	2	4	–
	290	149	75	22

Hampden County.

	Total.	Buck.	Doe.	Wounded.
Blandford,	16	11	5	–
Brimfield,	12	11	1	–
Chester,	33	17	11	4
Chicopee,	7	4	3	1
Granville,	17	6	4	–
Hampden,	5	4	1	–

Returns of the Open Season on Deer in Massachusetts, Nov. 21-26, 1910, inclusive—Continued.

Hampden County — Concluded.

	Total.	Buck.	Doe.	Wounded.
Holland,	2	2	–	–
Holyoke,	2	2	–	–
Longmeadow,	5	3	2	1
Ludlow,	21	13	7	2
Monson,	11	6	4	–
Montgomery,	10	3	6	1
Palmer,	24	15	8	2
Russell,	8	3	–	–
Southwick,	17	11	4	2
Springfield,	3	2	1	–
Tolland,	2	–	1	–
Wales,	2	1	1	–
Wilbraham,	24	12	11	2
Westfield,	11	6	2	–
	231	131	72	15

Hampshire County.

	Total.	Buck.	Doe.	Wounded.
Amherst,	5	2	3	–
Belchertown,	16	6	8	1
Cummington,	12	4	4	3
Chesterfield,	9	3	–	–
Enfield,	10	3	6	1
Goshen,	4	3	–	–
Granby,	7	5	–	–
Greenwich,	8	4	3	2
Hadley,	5	2	1	–
Hatfield,	8	5	1	1
Huntington,	20	10	3	1
Middlefield,	17	9	2	–
Northampton,	4	2	–	–
Pelham,	5	1	–	1
Plainfield,	6	5	1	1
Prescott,	7	2	2	3
Southampton,	9	5	4	–
Ware,	21	10	6	3

Returns of the Open Season on Deer in Massachusetts, Nov. 21–26, 1910, inclusive — Continued.

Hampshire County — Concluded.

	Total.	Buck.	Doe.	Wounded.
Westhampton,	11	7	1	2
Williamsburg,	6	1	2	1
Worthington,	10	6	3	–
	200	95	50	20

Worcester County.

	Total.	Buck.	Doe.	Wounded.
Ashburnham,	3	1	1	1
Athol,	17	12	3	2
Barre,	26	12	8	1
Berlin,	1	–	1	–
Blackstone,	3	2	–	2
Bolton,	8	4	2	–
Boylston,	5	1	2	3
Brookfield,	14	5	6	1
Charlton,	10	3	3	–
Clinton,	3	1	–	–
Dana,	10	8	–	–
Douglas,	7	3	1	3
Dudley,	2	–	–	–
Gardner,	2	–	–	–
Grafton,	16	6	7	3
Hardwick,	20	10	5	1
Harvard,	43	23	13	2
Holland,	4	–	–	–
Holden,	10	7	2	1
Hubbardston,	10	7	3	–
Lancaster,	20	12	6	1
Leicester,	1	1	–	–
Leominster,	6	3	2	1
Lunenburg,	21	11	7	2
Mendon,	2	1	1	–
Millbury,	1	–	–	–
Milford,	3	2	1	–
Northborough,	3	1	–	–
Northbridge,	2	1	1	–

Returns of the Open Season on Deer in Massachusetts, Nov. 21–26, 1910, inclusive — Concluded.

Worcester County — Concluded.

	Total.	Buck.	Doe.	Wounded.
Oakham,	6	2	2	–
Oxford	2	–	–	–
Paxton,	3	2	1	–
Petersham,	8	4	4	–
Phillipston,	9	6	1	2
Princeton,	6	5	1	–
Royalston,	6	4	2	–
Rutland,	11	5	4	–
Southborough,	6	4	1	–
Southbridge,	2	–	–	1
Spencer,	24	11	5	4
Sterling,	12	2	2	–
Sturbridge,	6	3	1	1
Sutton,	5	1	–	–
Templeton,	12	6	6	–
Upton,	1	–	1	–
Uxbridge,	7	5	2	1
Warren,	2	1	1	–
Webster,	2	–	–	–
Westborough,	5	3	1	–
Westminster,	10	6	3	–
Winchendon,	12	8	2	–
	436	214	115	[illegible]

In addition, there are 8 deer which I am unable to place, owing to the fact that in their excitement some of the hunters failed to sign their names or to give town or date of killing.

Circular letters were sent to all paid deputies before the open season requesting them to keep a careful record of all deer shot and send same to the office. Much valuable information was secured and many complicated cases straightened out.

The youngest persons to report the shooting of deer were boys, one twelve years and seven months old and the other thirteen years old. Both of these boys shot bucks.

The largest buck reported was shot at Blandford by a Springfield sportsman, and weighed 450 pounds. The largest doe was shot by a Pittsfield sportsman in Hancock, and weighed 300 pounds.

There have been 16 dead deer found by the hunters and deputies since the season closed, which were probably wounded during the open season. Seven deer have been found wounded; these were killed by deputies of this department since the close of the open season.

Summary.

Total killed in open season, on record,	1,281
Total wounded in open season, on record,	101
Total killed, not placed on record,	8
Found dead, probably shot in open season,	16
Found wounded and shot by deputies,	7
Grand total,	1,413
Total number of reports received,	1,413

The passage of chapter 138 of the Acts of 1901 gave the Commissioners on Fisheries and Game and their deputies authority to arrest persons for taking shellfish in contaminated waters, when so requested by the State Board of Health. This act was first applied to the local waters of New Bedford and Fairhaven in 1904. The following is a record of the numbers of arrests and fines: —

1904, 28 arrests; all cases filed.
1905, 50 arrests; fines, $215; cases filed, 11.
1906, 49 arrests; fines, $265; cases filed, 4.
1907, 54 arrests; fines, $720; defaulted, 2.
1908, 66 arrests; fines, $750; filed, 2; discharged, 2.
1909, 37 arrests; fines, $380; filed, 3.
1910, 54 arrests; fines, $560; filed, 4.

In 1907 this same act was applied to Boston and Quincy waters. The following is a record of the number of arrests and fines: —

1907, 20 arrests; fines, $65; filed, 10.
1908, 11 arrests; fines, $75; filed, 2.
1909, 19 arrests; fines, $140; filed, none.
1910, 19 arrests; fines, $115; discharged, 2; defaulted, 1.

In 1909 this act was applied to Lynn, Revere and Saugus waters. The following is a record of the number of arrests and fines: —

1909, 21 arrests; fines, $175; filed, 3.
1910, 8 arrests; fines, $30; filed, 3; discharged, 1.

Lobsters collected. — During the year just closed the deputies of the department have collected egg-bearing lobsters as follows: —

Bourne, 61 lobsters in count; expenses, $0.50.
Lowe, 24 lobsters in count; expenses, $0.40.
Mecarta, 1,563 lobsters in count; expenses, $103.06.
Holmes, 488 lobsters in count; salary and expenses, $572.63.
Nixon, 1,950 lobsters in count; expenses, $56.23.
Nixon sold to United States hatchery, Gloucester, 532 lobsters, count.
Nixon sold to United States hatchery Woods Hole 151 lobsters count.
Nixon liberated 1,267 lobsters, count.
Total expenses of collecting, shipping and liberating 4,086 lobsters, $732.82.

This table shows the expense contracted in this work, outside of the price paid for the lobsters. The prices paid range from 14 to 30 cents per pound during the year, following the market.

We believe that the expense necessary to carry out the provisions of chapter 408 of the Acts of 1904, under which the above work is done, exceeds the good results shown. Since the majority of the lobster fishermen and dealers are unable to realize that the work is carried on primarily for their benefit, and appear to be unwilling to co-operate, we suggest the repeal of that part of the law which permits the egg lobsters to be purchased.

Following is the record of arrests and convictions for the year ending Dec. 31, 1910: —

Number of persons arrested,	337
Number of complaints,	356
Number of offences,	39
Most arrests for one offence was for taking shellfish in contaminated water,	81
Next largest was for hunting without a license,	37

Classification of Arrests during the Year 1910.

Violation of: —

Acts of 1904, chapter 329, relative to pickerel,	2
Acts of 1910, chapter 469, relative to trout,	10
Acts of 1907, chapter 306, relative to closed ponds,	13
Acts of 1904, chapter 308, relative to fishing with more than ten hooks,	1
Acts of 1907, chapter 285, relative to shellfish in contaminated waters,	78
Acts of 1906, chapter 477, relative to shellfish in the town of Dartmouth,	2
Acts of 1909, chapter 291, relative to torching,	15
Revised Laws, chapter 91, section 133, as amended by Acts of 1903, chapter 246, relative to poison in brook,	1
Acts of 1855, chapter 401, relative to seining,	1
Acts of 1908, chapter 492, relative to illegal apparatus,	9
Revised Laws, chapter 91, section 85, relative to taking clams without permit,	1
Revised Laws, chapter 91, section 85, relative to taking eels without permit,	1

Acts of 1910, chapter 177, relative to seed scallops,	2
Revised Laws, chapter 91, sections 71 and 74, relative to smelts,	7
Revised Laws, chapter 91, section 70, relative to bass,	3
Revised Laws, chapter 91, section 86, relative to lobsters,	3
Revised Laws, chapter 91, section 88, relative to lobsters,	11
Revised Laws, chapter 92, section 14, relative to posted land,	2
Revised Laws, chapter 91, section 52, relative to seining,	1
Revised Laws, chapter 91, section 122, relative to gill nets,	1
Revised Laws, chapter 91, section 85, relative to quahaugs,	3
Assault on deputy,	2
Acts of 1904, chapter 176, relative to hunting on the Lord's day,	29
Acts of 1910, chapter 365, relative to partridge,	3
Acts of 1909, chapter 309, relative to pheasants,	6
Acts of 1907, chapter 250, relative to song and insectivorous birds,	12
Acts of 1903, chapter 244, relative to heron,	2
Acts of 1903, chapter 244, relative to bittern,	1
Acts of 1910, chapter 472, relative to terns,	1
Acts of 1909, chapter 421, relative to ducks,	1
Acts of 1903, chapter 329, relative to use of feathers for millinery purposes,	7
Acts of 1908, chapter 402, relative to alien license,	28
Acts of 1909, chapter 262, relative to non-resident licensee,	3
Acts of 1909, chapter 325, relative to registration of hunters,	42
Acts of 1909, chapter 396, and Acts of 1910, chapter 545, relative to deer,	21
Acts of 1905, chapter 245, relative to dogs chasing deer,	7
Acts of 1910, chapter 564, relative to squirrels,	10
Acts of 1909, chapter 328, relative to snaring,	4
Acts of 1910, chapter 355, relative to ferrets,	7
Acts of 1907, chapter 299, relative to forest fires,	2
Number of hunters' licenses revoked for violation of game laws,	39

Comparative Table of Law Enforcement for the Years 1907–10.

Items.	1907.	1908.	1909.	1910.
Total fines imposed,	$3,470 20	$7,097 50	$5,804 50	$3,740 00
Fines from arrests by paid deputies,	$1,921 20	$6,348 50	$5,400 50	$3,604 00
Fines from arrests by unpaid deputies,	$1,549 00	$759 00	$404 00	$136 00
Total counts taken to court,	390	472	417	355
Total number of persons arrested,	358	455	383	333
Convictions,	327	424	397	322
Cases filed,	63	77	59	55
Cases discharged,	56	45	19	31
Cases defaulted,	7	2	1	2
Costs paid when cases were filed,	–	–	$54 90	$102 69

One lobster case, with fine of $45, still pending.

Two cases appealed from 1908, of which one paid $20 fine, the other paid $53 fine, not included in above table.

Forest Fires. — The number of forest fires discovered by deputies of the department, who rendered assistance in extinguishing the same, were as follows: —

Deputy Burney,	3	Deputy Ruberg,	1
Deputy Brown,	1	Deputy Tribou,	4
Deputy Converse,	5	Deputy Stratton,	2
Deputy Hatch,	1	Deputy Scudder,	1
Deputy Keniston,	1	Deputy Osborne,	4
Deputy Leonard,	10		
Deputy Mills,	5		38

In narrative report ending Dec. 11, 1910, Deputy Albert L. Stratton says: —

December 7, left home at 9 A.M. Went to Orange by street car. On foot to Partridgeville and Eagleville ponds. While at Partridgeville heard shouting; lady calling for help; house was on fire. Was the first one there. Helped move out furniture. House burned down.

In accordance with chapter 272, Acts of 1909, and chapter 421, Acts of 1909, I have sealed up at the various cold storage warehouses during the year 1910, 113 packages containing the following: —

Black ducks,	1,093	Brant,	8
Widgeons,	666	Teal,	74
Mallards,	169	Quail,	46
Red-heads,	153	Grass birds,	54
Canvas-backs,	69	Peeps,	178
Butterballs,	54	Miscellaneous,	13
Miscellaneous ducks,	118		
Wild geese,	82		2,777

To show the interest which the public take in the fish and game laws, I would say that 67 bills were introduced in the Legislature during the session of 1910 relating to these matters. This does not include 21 recommendations made by the commissioners.

Respectfully submitted,

W. W. NIXON,
Chief Deputy.

Money turned into the Treasury of the Commonwealth as the Result of the Activities of the Commission during the Year 1910.

Total net receipts from all forms of hunting licenses,	$34,666 75
Sale of egg-bearing lobsters,	838 79
Fines from prosecutions by deputies,	3,720 00
Received for heath-hen fund (from Anawan Club),	25 00
	$38,506 54

There have been no applications for the inspection of fish under the Acts of 1902, chapter 138, and no fees have been received.

Recommendations for Legislation.

The Commissioners on Fisheries and Game respectfully recommend the passage of laws designed to accomplish the following purposes: —

1. Inasmuch as experience has shown that it is impossible to depend upon commercial sources for fish for stocking public waters, and the hatcheries at present owned by the State are entirely inadequate to meet the requirements (*e.g.,* not less than 5,000,000 fry and 1,000,000 fingerling trout, together with white perch and other desirable species, are demanded), the commissioners should be authorized to lease, purchase or construct one or more suitable fish hatcheries.

2. Special investigations should be made to determine how those birds which feed upon gypsy moth, brown-tail moths, leopard moths, cut worms and other noxious insects can be increased or colonized within the infested regions or in special locations.

3. On account of the alarming decrease in the number of useful birds, and the consequent damage from insect pests to shade trees, garden and farm crops, some provision for rearing game and insectivorous birds should be made. We therefore urge that the commissioners be authorized to lease, purchase and construct increased facilities for rearing useful, insectivorous and game birds.

4. That the commission should have authority to purchase, lease or receive as gifts, areas to be used as bird reservations, *i.e.,* specially protected breeding places for birds. Property thus acquired should be administered by the Commissioners on Fisheries and Game for the purpose of securing the utmost possible population of useful birds. Whenever necessary to confirm titles, power of eminent domain should be given similar to that in chapter 504, Acts of 1907; and part of that money received by the Commonwealth for hunters' licenses should annually be expended for the purpose of acquiring land for such purposes.

5. That investigation be made of the infectious diseases of native birds and foreign birds introduced into the State, with

a report including expert opinions upon the probability of such diseases spreading among our native birds, and, so far as possible, suggesting remedies and methods for preventing such infection; and that for these purposes money be appropriated from money received by the Commonwealth for hunting licenses.

6. Relative to the introduction of fish into State waters.

7. Amendments perfecting the laws relative to ruffed grouse, quail and woodcock.

8. On petition of the mayor and aldermen of a city, or of the selectmen of a town within which a great pond or any portion thereof is situated, the Commissioners on Fisheries and Game may prescribe and extend such reasonable regulations relative to the fishing in such ponds and their tributaries, with such penalties, as they deem to be for the public interest, and shall cause such regulations to be enforced.

9. Also, under Acts of 1908, chapter 484, relative to registration of hunters, the persons applying for a license should be required to establish their identity; and, for the purpose of permitting effective enforcement, the requirements for license or registration should be extended to all persons hunting for any species of bird or mammal, and should further require that the license or certificate of registration should be carried on the person when hunting. Minors under sixteen years of age making application for registration should be obliged to have the consent of their parents or guardian in writing. Upon conviction of violation of game laws, persons holding licenses should be instructed by the court convicting them to surrender such license to the court.

10. Also, for such amendment of the laws as to ensure the development of the mollusk fisheries below high-water mark in such a manner as to permit increase in the economic yield of food material; to furnish wider opportunities for remunerative employment of skilled and unskilled labor.

11. Protection of gray, European or Hungarian partridge.

12. Protection of wood or summer duck.

13. Chapter 285, Acts of 1907, which permits the taking of clams and quahaugs from contaminated waters, should be repealed, or other necessary action taken.

14. Dogs should not be allowed to hunt at large habitually unaccompanied by owner during the breeding season of birds in areas frequented by them, from March 1 to October 1.

15. The deputies of this commission should be authorized to arrest hunters whom they find in the act of violating the provisions of section 91 of chapter 208 of the Revised Laws relative to wilfully pulling down stone walls or fences.

16. Protection of property injured by gray squirrels.

17. A perfecting amendment relative to protection and sale of hares and rabbits.

18. A perfecting amendment relative to protection of game birds and water fowl.

19. A perfecting amendment to section 1, chapter 317, Acts of 1905, relative to the carrying of firearms by unnaturalized foreign-born persons.

Courtesies.

Permits to hold egg-bearing lobsters in confinement, for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 607 fishermen and dealers.

Permits for taking birds and eggs, under section 9, chapter 92, Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following-named persons: —

Frank B. Webster, Hyde Park.
Albert H. Tuttle, Cambridge.
Clarence Birdseye, Amherst.
Chester S. Day, West Roxbury.
Chester A. Reed, Worcester.
Fred B. McKechnie, Boston.
Wm. Brewster, Cambridge.
Charles R. Lamb, Boston.
Edward R. Adams, Canton.
Henry P. Burt, New Bedford.
R. H. Carr, Brockton.
B. G. Willard, Millis.
Geo. M. Gray, Woods Hole.
A. C. Bent, Taunton.
Nathan F. Stone, Shrewsbury.
Robert O. Morris, Springfield.
Haynes H. Chilson, Northampton.
F. A. Binford, Hyannis.
Frederic H. Kennard, Boston.
F. H. Carpenter, Taunton.
J. A. Barton, Fitchburg.
William Dearden, Springfield.
Owen Durfee, Fall River.
Frank S. Akin, Fall River.
John H. Hardy, Jr., Boston.
James R. Mann, Arlington Heights.
Thos. M. Douthart, Woods Hole.
A. M. Wilcox, Wellesley.
Fred P. Hersom, Chelsea.
E. H. Forbush, Boston.

Permits to have wild ducks in possession, for purposes of propagation, were issued to: —

Seth A. Borden, Fall River.
Spencer Borden, Fall River.
Clark Chase, Jr., Fall River.
Alfred V. Freeman, South Duxbury.
Guilford C. Hathaway and Benjamin Brown, Fall River.
Allan Keniston, Edgartown.
A. D. Kingsbury, Medfield.
H. S. Little, Newbury.
Miss E. W. Magee, Holliston.
Frederick E. Mosher, New Bedford.
John C. Phillips, Wenham.
William A. Read, New Bedford.
James E. Rothwell, Brookline.
William H. Thurston, Chiltonville.
R. E. Warren, Sharon.
Frank E. White, Saundersville.

Permits to have wild geese in possession, for purposes of propagation, were issued to: —

A. D. Kingsbury, Medfield.
H. S. Little, Newbury.
Frederick E. Mosher, New Bedford.
James E. Rothwell, Brookline.

Permits to have ruffed grouse in possession, for purposes of propagation, were issued to: —

Mrs. Oakes Ames, Sharon.
Miss Lorna H. Leland, Templeton.
Herbert Parker, Lancaster.
James E. Rothwell, Brookline.

Permits to have quail in possession, for purposes of propagation, were issued to: —

Spencer Borden, Fall River.
John Goulding, South Sudbury.
C. F. Hodge, Worcester.
Wm. H. Leonard, East Foxborough.
Wm. A. Read, New Bedford.
James E. Rothwell, Brookline.

Permit to take birds and animals protected by law, for scientific purposes, was issued to: —

Gardner C. Basset, Worcester.

Permit to take sea birds, for scientific purposes, was issued to: —

Vinal N. Edwards, Woods Hole.

Permit to have native insectivorous birds in possession, to be used in connection with experiments and observations upon the use of birds for destroying certain flies in greenhouses, was issued to: —

Seth A. Borden, Fall River.

Permit to have native insectivorous birds in possession, for purposes of propagation, was issued to: —

James E. Rothwell, Brookline.

Permit to trap gray squirrels, for transfer to other parts of the State, was issued to: —

Frederick D. Woods, Wellesley.

Permit to collect and have in possession the nests of wild birds, after they have been vacated, was issued to: —

Arthur A. Osborne, Peabody.

Permit to have swans in possession, for purposes of propagation, was issued to: —

George H. Walker, Needham.

Permits to bring into the Commonwealth during the close season not exceeding fifty birds known as Anatidæ, in accordance with the provisions of section 2, chapter 421, Acts of 1909, were issued to: —

R. L. Agassiz, Boston.
Ingersoll Amory, Boston.
James W. Austin, Boston.
Charles F. Ayer, Boston.
Thomas Barbour, Brookline.
Decim Beebee, Boston.
John N. Beebee, Boston.
Frank B. Bemis, Boston.
Henry B. Bigelow, Cambridge.
G. F. Blake, Weston.
F. J. Bradlee, Boston.
Gorham Brooks, Boston.
Henry B. Chapin, Boston.
James M. Codman, Brookline.
C. P. Curtis, Boston.
F. W. Curtis, Boston.
Daniel Dewey, Boston.
William B. Emmons, Boston.
H. B. Endicott, Boston.
H. Wendell Endicott, Dedham.
Henry H. Fay, Jr., Boston.
Norman F. Greeley, Boston.
Samuel Hammond, Nahant.
J. Hurd Hutchins, Boston.
Eben D. Jordan, Boston.
Robert Jordan, Boston.
Wilton Lockwood, Boston.
Arthur Lyman, Waltham.
George H. Lyman, Boston.
Theodore Lyman, Cambridge.
F. S. Mead, Brookline.
Charles Merriam, Weston.
Arthur N. Milliken, Boston.
S. J. Mixter, Boston.
William Jason Mixter, Boston.
James C. Neeley, Brookline.
Albert L. Nickerson, Boston.
J. H. North, Boston.
Eben C. Norton, Norwood.
Charles J. Paine, Jr., Weston.

John B. Paine, Weston.
William A. Patterson, Boston.
Dudley L. Pickman, Boston.
C. A. Porter, Boston.
J. L. Saltonstall, Boston.
Richard Saltonstall, Boston.
Thomas Silsbee, Boston.
William H. Slocum, Boston.
Bayard Thayer, Lancaster.
William G. Titcomb, Boston.
C. N. Tyler, Boston.
J. D. Upton, Boston.
Benjamin Vaughan, Boston.
Henry G. Vaughan, Boston.
B. Vincent, Boston.
Arthur Wainwright, Boston.
Roger S. Warner, Boston.
Moses Williams, Boston.
Paul Winsor, Weston.

Permits to bring into the Commonwealth during the close season not exceeding fifty birds known as Limicolæ, in accordance with the provisions of chapter 508, Acts of 1909, were issued to: —

Charles J. Paine, Jr., Weston.
B. Vincent, Boston.

Permits to rear and sell pheasants, in accordance with the provisions of chapter 309, Acts of 1909, were issued to: —

Howard E. Newton, Foxborough.
Thos. R. Sherburne, Lexington.
Frederick W. Fisher, Newton.
Albert L. Brown, Cohasset.
Andrew S. Coyle, Taunton.
Minnie Blagden, Rowley.
H. S. Little, Newbury.
Austin L. Millett, Rowley.
Milan A. Brayton, Fall River.
Grenville L. Winthrop, Lenox.
Charles M. Emerson, Taunton.
Edward C. Alden, Taunton.
C. L. Converse, Stoneham.
Elmer A. Macker, North Grafton.
James Ashton, Fall River.
A. N. Reynolds, Westwood.
Chester H. Keyes, Middleborough.
E. H. Allen, Stoneham.
S. B. S. Keyes, Middleborough.
Frank R. Boston, Beverly.
G. Marston Whitin, Whitinsville.
John Clark, Brockton.
J. Goulding, South Sudbury.
Geo. M. Ballard, Danvers.
Charles F. Berry, Needham Heights.
Bayard Thayer, Lancaster.
E. P. Wilbur, South Framingham.
Seth A. Borden, Fall River.
John C. Phillips, Boston.
M. J. McQuaid, Clinton.
Spencer Borden, Fall River.
Frederick E. Mosher, New Bedford.
James E. Rothwell, Brookline.
Irene Pettis, Mill River.
Frank A. Lemmer, Easthampton.
W. H. Palmer, Beverly.
Allan Keniston, Edgartown.
Thos. Barry, Marblehead.
Annie E. Freeman, Provincetown.
A. D. Kingsbury, Medfield.
J. H. Hathaway, New Bedford.
Oscar D. Young, North Beverly.
Axel Klinglof, Worcester.
Harry C. Ashby, Topsfield.
Edward B. Woodbury, Topsfield.
Thomas Mallery, Natick.
Edward Herbert, Fall River.
Robert Montgomery, Natick.
Frank P. Hewins, South Framingham.
Robert W. Harwood, Natick.
William A. Read, New Bedford.

W. R. Morrill, South Framingham.
L. W. Prouty, South Framingham.
George D. Flynn, Fall River.
Theodore K. Grimsby, Essex.
C. A. Osgood, Arlington.
Bert Meek, Lexington.
J. Raymond Adams, Newbury.
Ferdinand B. Sage, South Sudbury.
Isaac U. Wood, Fall River.
Frank E. White, Saundersville.
Albert A. Hall, Lowell.
Leander F. Herrick, Worcester.
William Sim, Cliftondale.
Joseph Gardella, Haverhill.
Mrs. Alexander Gilmore, Fayville.
W. S. Allison, Merrimacport.
E. F. Parmlee, Boston.
George McNeil, Winthrop.
Clarence C. Puffer, Brockton.
Charles Whittemore, Newton.

Permit to have in possession lobsters of any size, for scientific investigation, issued to: —

Marine Biological Laboratory, Woods Hole.

Permit to take lamprey eels, for scientific purposes, was issued to: —

Geo. M. Gray, Curator of the Marine Biological Laboratory, Woods Hole.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to: —

James Crooks, Newburyport.
A. P. Hilton, Newburyport.
George E. Pettingill, Newburyport.

Permit to operate a pound net in Buzzards Bay was issued to: —

Marine Biological Laboratory, Woods Hole.

Permit to transfer fish from one stream to another was issued to: —

Louis E. Vose, East Walpole.

Permit to use a seine in any of the ponds in Barnstable County, to secure spawning white perch, was issued to: —

Everett B. Mecarta, Harwich.

Permits to have small trout in possession, for purposes of study, were issued to: —

W. Hewins Thayer, New Bedford.
W. C. Phillips, New Bedford.

Permit to take fish of any species, for scientific investigation, was issued to: —

L. W. Tilden, Fairhaven.

Permits to buy and sell or have in possession trout artificially propagated and maintained, in accordance with the provisions of chapter 377, Acts of 1909, were issued to: —

Sandwich Trout Company, Sandwich.
A. B. Savery, Wareham.
Jacob Diegel, Agawam.
N. F. Hoxie, Plymouth.
Wm. A. Gaston, Barre.
Chas. R. Doten, Plymouth.
Prior & Townsend, Boston.
Michael J. Welch, Boston.
H. A. Baker, Sharon.
Shattuck & Jones, Boston.
S. Atwood & Co., Boston.
Lane Bros., Silver Lake.
Geo. L. Guptill, Berkley.
F. H. Johnson & Co., Boston.
Gove & Mollins, Boston.
C. M. Bassett, New Bedford.
Rich & Matthews, Boston.
W. S. Nickerson, Kingston.
G. W. Shultis, Hartsville.
G. W. Randall, Plympton.
Watson Bros., New Bedford.
Atlantic Fish Market (Long & Hanitsch), Campello.
L. W. Tilden, Fairhaven.

GEORGE W. FIELD.
GEORGE H. GARFIELD.
GEORGE H. GRAHAM.

APPENDICES.

[A.]

Deputy Fish and Game Commissioners, with the Number of their Districts, Residences and Telephone Numbers.

William W. Nixon, *Chief Deputy*, Central Office, State House. Telephone, Hay. 2700; residence telephone, 466-2 Cambridge.

Assigned to District —	Name.	Residence.	Telephone Number.
1	William H. Jones,	Nantucket,	24-32
2	Charles L. Savery,	West Tisbury,	-
	Allan Keniston,	Edgartown,	6-21
3	Everett B. Mecarta,	Harwich,	36-4
4	Samuel J. Lowe,	New Bedford,	761-2
5	Allen A. David,	Taunton,	966-1
6	Nathan W. Pratt,	Middleborough,	153-4
7	Charles E. Tribou,	Brockton,	2101
8	William Day,	Marshfield,	50
9	William H. Leonard,	East Foxborough,	Foxborough 9-4
10	James E. Bemis,	South Framingham,	564-J
11	William W. Nixon, *Chief Deputy*,	Cambridge,	2248-W
	Frederick W. Goodwin,	East Boston,	515-2
12	-	-	-
13	Walter A. Larkin,	Andover,	172-5
14	Thomas L. Burney,	Lynn,	1613-13
15	James I. Mills,	Ayer,	51-2
16	George H. Brown,	Millbury,	26-13
17	A. D. Putnam,	Spencer,	75-4 or 75-6
18	Irving O. Converse,	Fitchburg,	269-1
19	Albert L. Stratton,	Athol,	24-O
20	Dennis F. Shea,	Ware,	132
21	John F. Luman,	Palmer,	17-5
22	James P. Hatch,	Springfield,	2458-1
23	Charles H. Gehle,	Westfield,	843 or 920
24	William W. Sargood,	Northampton,	-
25	Lyman E. Ruberg,	Greenfield,	585-
26	Arthur M. Nichols,	North Adams,	537-2
27	Fred R. Zeigler,	Pittsfield,	362-11
28	DeWitt Smith,	Great Barrington,	72-6

The following were employed as special paid deputies:—

Name.	Residence.	Term of Service (1910).
John M. Dineen,	Easthampton,	Nov. 1–Nov. 30.
Albert H. Eldredge,	Ware,	Sept. 20–Nov. 30.
Gilbert A. Gildrie,	Pittsfield,	Nov. 22–Nov. 28.
Warren A. Goff,	Dighton,	Oct. 10–Nov. 30.
Chester H. Hall,	Princeton,	Nov. 23–Nov. 28.
Wm. E. Holland,	West Brimfield,	Nov. 24–Nov. 30.
Charles L. Houghton,	Westfield,	Nov. 12–Dec. 31.
Harry L. Lyford,	Spencer,	Oct. 1–Nov. 30.
Geo. C. Paradise,	Fall River,	Sept. 6–Dec. 31.
Geo. W. Piper,	Andover,	Oct. 22–Nov. 30.
Wm. N. Prentiss,	Milford,	Sept. 6–Nov. 30.
Michael S. Ryan,	Oakdale,	Nov. 19–Nov. 28.
Lindsey G. Smith,	Dwight,	Nov. 19–Nov. 28.
Patrick J. Woods,	New Bedford,	Oct. 7–Nov. 30.
Geo. W. Williams,	Worcester,	Nov. 3–Dec. 31.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included.

8 Abington.
15 Acton.
4 Acushnet.
26 Adams.
23 Agawam.
28 Alford.
12 Amesbury.
22 Amherst.
13 Andover.
11 Arlington.
18 Ashburnham.
18 Ashby.
25 Ashfield.
10 Ashland.
19 Athol.
5 Attleborough.
17 Auburn.
8 Avon.
15 Ayer.
3 Barnstable.
20 Barre.
27 Becket.
14 Bedford.
20 Belchertown.
9 Bellingham.
11 Belmont.
5 Berkley.
10 Berlin.
25 Bernardston.
13 Beverly.
14 Billerica.
16 Blackstone.
23 Blandford.
15 Bolton.
11 Boston.
3 Bourne.
15 Boxborough.
13 Boxford.
17 Boylston.
8 Braintree.
3 Brewster.
7 Bridgewater.
21 Brimfield.
7 Brockton.
17 Brookfield.
11 Brookline.
25 Buckland.
14 Burlington.
11 Cambridge.
8 Canton.
15 Carlisle.
6 Carver.
25 Charlemont.
21 Charlton.
3 Chatham.
14 Chelmsford.
11 Chelsea.
26 Cheshire.
23 Chester.
24 Chesterfield.
22 Chicopee.
2 Chilmark.
26 Clarksburg.
17 Clinton.
8 Cohasset.
25 Colrain.
15 Concord.
25 Conway.
24 Cummington.
27 Dalton.
20 Dana.
13 Danvers.
4 Dartmouth.
11 Dedham.
25 Deerfield.
3 Dennis.
5 Dighton.
16 Douglas.
10 Dover.
14 Dracut.
21 Dudley.
15 Dunstable.
7 Duxbury.
7 East Bridgewater.
22 East Longmeadow.
3 Eastham.
24 Easthampton.
7 Easton.
2 Edgartown.
28 Egremont.
20 Enfield.
19 Erving.
12 Essex.
11 Everett.
4 Fairhaven.
5 Fall River.
2 Falmouth.
18 Fitchburg.
26 Florida.
9 Foxborough.
10 Framingham.
9 Franklin.
4 Freetown.
18 Gardner.
2 Gay Head.
12 Georgetown.
25 Gill.
12 Gloucester.
24 Goshen.
2 Gosnold.
16 Grafton.
22 Granby.
23 Granville.
28 Great Barrington.
25 Greenfield.
20 Greenwich.
15 Groton.
12 Groveland.
22 Hadley.
7 Halifax.
12 Hamilton.
22 Hampden.
26 Hancock.
8 Hanover.
7 Hanson.
20 Hardwick.
15 Harvard.
3 Harwich.
24 Hatfield.
13 Haverhill.
25 Hawley.
25 Heath.
8 Hingham.
27 Hinsdale.
8 Holbrook.
17 Holden.
21 Holland.
10 Holliston.
24 Holyoke.
16 Hopedale.
10 Hopkinton.
20 Hubbardston.
10 Hudson.
8 Hull.
23 Huntington.
11 Hyde Park.
12 Ipswich.
7 Kingston.
6 Lakeville.
18 Lancaster.
26 Lanesborough.
13 Lawrence.
27 Lee.
17 Leicester.
27 Lenox.
18 Leominster.
22 Leverett.
14 Lexington.
25 Leyden.
10 Lincoln.
15 Littleton.
22 Longmeadow.
14 Lowell.
22 Ludlow.
18 Lunenburg.
14 Lynn.
13 Lynnfield.
14 Malden.
12 Manchester.
9 Mansfield.
13 Marblehead.
4 Marion.
10 Marlborough.
8 Marshfield.
3 Mashpee.
4 Mattapoisett.
15 Maynard.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included — Concluded.

9 Medfield.
14 Medford.
9 Medway.
14 Melrose.
16 Mendon.
12 Merrimac.
13 Methuen.
6 Middleborough.
27 Middlefield.
13 Middleton.
10 Milford.
16 Millbury.
9 Millis.
11 Milton.
26 Monroe.
21 Monson.
19 Montague.
28 Monterey.
23 Montgomery.
28 Mount Washington.
14 Nahant.
1 Nantucket.
10 Natick.
11 Needham.
26 New Ashford.
4 New Bedford.
17 New Braintree.
28 New Marlborough.
20 New Salem.
12 Newbury.
12 Newburyport.
11 Newton.
9 Norfolk.
26 North Adams.
13 North Andover.
9 North Attleborough.
17 North Brookfield.
13 North Reading.
24 Northampton.
16 Northborough.
16 Northbridge.
19 Northfield.
5 Norton.
8 Norwell.
9 Norwood.
2 Oak Bluffs.
17 Oakham.
19 Orange.
3 Orleans.
28 Otis.
16 Oxford.
21 Palmer.
17 Paxton.
14 Peabody.
22 Pelham.
7 Pembroke.
15 Pepperell.
27 Peru.
20 Petersham.
19 Phillipston.
27 Pittsfield.
25 Plainfield.
9 Plainville.
6 Plymouth.
7 Plympton.
20 Prescott.
18 Princeton.
3 Provincetown.
8 Quincy.
8 Randolph.
7 Raynham.
13 Reading.
5 Rehoboth.
14 Revere.
27 Richmond.
4 Rochester.
8 Rockland.
12 Rockport.
26 Rowe.
12 Rowley.
19 Royalston.
23 Russell.
17 Rutland.
13 Salem.
12 Salisbury.
28 Sandisfield.
3 Sandwich.
14 Saugus.
26 Savoy.
8 Scituate.
5 Seekonk.
9 Sharon.
28 Sheffield.
25 Shelburne.
10 Sherborn.
15 Shirley.
16 Shrewsbury.
22 Shutesbury.
5 Somerset.
11 Somerville.
22 South Hadley.
24 Southampton.
10 Southborough.
21 Southbridge.
23 Southwick.
17 Spencer.
22 Springfield.
18 Sterling.
27 Stockbridge.
14 Stoneham.
8 Stoughton.
15 Stow.
21 Sturbridge.
10 Sudbury.
22 Sunderland.
16 Sutton.
14 Swampscott.
5 Swansea.
5 Taunton.
19 Templeton.
14 Tewksbury.
2 Tisbury.
23 Tolland.
13 Topsfield.
18 Townsend.
3 Truro.
15 Tyngsborough.
28 Tyringham.
16 Upton.
16 Uxbridge.
14 Wakefield.
21 Wales.
9 Walpole.
10 Waltham.
20 Ware.
6 Wareham.
21 Warren.
19 Warwick.
27 Washington.
11 Watertown.
10 Wayland.
16 Webster.
10 Wellesley.
3 Wellfleet.
19 Wendell.
13 Wenham.
17 West Boylston.
7 West Bridgewater.
21 West Brookfield.
12 West Newbury.
23 West Springfield.
27 West Stockbridge.
2 West Tisbury.
16 Westborough.
23 Westfield.
15 Westford.
24 Westhampton.
18 Westminster.
10 Weston.
4 Westport.
9 Westwood.
8 Weymouth.
24 Whately.
7 Whitman.
22 Wilbraham.
24 Williamsburg.
26 Williamstown.
14 Wilmington.
19 Winchendon.
14 Winchester.
26 Windsor.
11 Winthrop.
14 Woburn.
17 Worcester.
24 Worthington.
9 Wrentham.
3 Yarmouth.

List of Cities and Towns included in Each District assigned to Deputy Fish and Game Commissioners.

District No. 1.

Deputy William H. Jones, Nantucket.

Telephone, 24-32.

Nantucket.

District No. 2.

Deputy Charles L. Savery, West Tisbury.

Deputy Allan Keniston, Edgartown.

Telephone, 6-21.

Chilmark.
Edgartown.
Falmouth.
Gay Head.
Gosnold.
Oak Bluffs.
Tisbury.
West Tisbury.

District No. 3.

Deputy Everett B. Mecarta, Harwich.

Telephone, 36-4.

Barnstable.
Bourne.
Brewster.
Chatham.
Dennis.
Eastham.
Harwich.
Mashpee.
Orleans.
Provincetown.
Sandwich.
Truro.
Wellfleet.
Yarmouth.

District No. 4.

Deputy Samuel J. Lowe, New Bedford.

Telephone, 761-2.

Acushnet.
Dartmouth.
Fairhaven.
Freetown.
New Bedford.
Mattapoisett.
Marion.
Rochester.
Westport.

District No. 5.

Deputy Allen A. David, Taunton.

Telephone, 966-1.

Attleborough.
Berkley.
Dighton.
Fall River.
Norton.
Rehoboth.
Seekonk.
Swansea.
Somerset.
Taunton.

District No. 6.

Deputy Nathan W. Pratt, Middleborough.

Telephone, 153-4.

Carver.
Lakeville.
Middleborough.
Plymouth.
Wareham.

District No. 7.

Deputy Charles E. Tribou, Brockton.

Telephone, 2101.

Bridgewater.
Brockton.
Duxbury.
East Bridgewater.
Easton.
Halifax.
Hanson.
Kingston.
Pembroke.
Plympton.
Raynham.
West Bridgewater.
Whitman.

District No. 8.

Deputy William Day, Marshfield.

Telephone, 50.

Abington.
Avon.
Braintree.
Canton.
Cohasset.
Hanover.
Hingham.
Holbrook.
Hull.
Marshfield.
Norwell.
Quincy.
Randolph.
Rockland.
Scituate.
Stoughton.
Weymouth.

District No. 9.

Deputy William H. Leonard, East Foxborough.

Telephone, Foxborough 9-4.

Bellingham.
Foxborough.
Franklin.
Mansfield.
Medfield.
Medway.
Millis.
Norfolk.
North Attleborough.
Norwood.
Plainville.
Sharon.
Walpole.
Westwood.
Wrentham.

District No. 10.

Deputy James E. Bemis, South Framingham.

Telephone, 226-J.

Ashland.
Berlin.
Dover.
Framingham.
Holliston.
Hopkinton.
Hudson.
Lincoln.
Marlborough.
Milford.
Natick.
Sherborn.
Sudbury.
Southborough.
Waltham.
Wayland.
Wellesley.
Weston.

District No. 11.

Deputy Frederick W. Goodwin, East Boston.

Telephone, East Boston, 515-2.

Arlington.
Belmont.
Boston.
Brookline.
Cambridge.
Chelsea.
Dedham.
Everett.
Hyde Park.
Milton.
Needham.
Newton.
Somerville.
Watertown.
Winthrop.

DISTRICT NO. 12.

Deputy CARL E. GRANT, Essex.

Telephone, Essex 1-3.

Amesbury.
Essex.
Georgetown.
Gloucester.
Groveland.
Hamilton.
Ipswich.
Manchester.
Merrimac.
Newbury.
Newburyport.
Rockport.
Rowley.
Salisbury.
West Newbury.

DISTRICT NO. 13.

Deputy WALTER A. LARKIN, Andover.

Telephone, Andover 31-12.

Andover.
Beverly.
Boxford.
Danvers.
Haverhill.
Lawrence.
Lynnfield.
Marblehead.
Methuen.
Middleton.
North Andover.
North Reading.
Reading.
Salem.
Topsfield.
Wenham.

DISTRICT NO. 14.

Deputy THOMAS L. BURNEY, Lynn.

Telephone, 1613-13.

Bedford.
Billerica.
Burlington.
Chelmsford.
Dracut.
Lexington.
Lowell.
Lynn.
Malden.
Medford.
Melrose.
Nahant.
Peabody.
Revere.
Saugus.
Stoneham.
Swampscott.
Tewksbury.
Wakefield.
Wilmington.
Winchester.
Woburn.

DISTRICT NO. 15.

Deputy JAMES I. MILLS, Ayer.

Telephone, 51-2.

Acton.
Ayer.
Bolton.
Boxborough.
Carlisle.
Concord.
Dunstable.
Groton.
Harvard.
Littleton.
Maynard.
Pepperell.
Shirley.
Stow.
Tyngsborough.
Westford.

DISTRICT NO. 16.

Deputy GEORGE H. BROWN, Millbury.

Telephone, 26-13.

Blackstone.
Douglas.
Grafton.
Hopedale.
Mendon.
Millbury.
Northborough.
Northbridge.
Oxford.
Shrewsbury.
Sutton.
Upton.
Uxbridge.
Webster.
Westborough.

District No. 17.

Deputy A. D. Putnam, Spencer.

Telephone, 75-4 or 75-6.

Auburn.	Leicester.	Rutland.
Boylston.	New Braintree.	Spencer.
Brookfield.	North Brookfield.	West Boylston.
Clinton.	Oakham.	Worcester.
Holden.	Paxton.	

District No. 18.

Deputy Irving O. Converse, Fitchburg.

Telephone, 269-1.

Ashby.	Lancaster.	Sterling.
Ashburnham.	Leominster.	Townsend.
Fitchburg.	Lunenburg.	Westminster.
Gardner.	Princeton.	

District No. 19.

Deputy Albert L. Stratton, Athol.

Telephone, 24-O.

Athol.	Orange.	Warwick.
Erving.	Phillipston.	Wendell.
Montague.	Royalston.	Winchendon.
Northfield.	Templeton.	

District No. 20.

Deputy Dennis F. Shea, Ware.

Telephone, 132.

Barre.	Greenwich.	Petersham.
Belchertown.	Hardwick.	Prescott.
Dana.	Hubbardston.	Ware.
Enfield.	New Salem.	

District No. 21.

Deputy John F. Luman, Palmer.

Telephone, 17-5.

Brimfield.	Monson.	Wales.
Charlton.	Palmer.	Warren.
Dudley.	Southbridge.	West Brookfield.
Holland.	Sturbridge.	

District No. 22.

Deputy James P. Hatch, Springfield.

Telephone, 2571-3.

Amherst.	Hampden.	Shutesbury.
Chicopee.	Leverett.	South Hadley.
East Longmeadow.	Longmeadow.	Springfield.
Granby.	Ludlow.	Sunderland.
Hadley.	Pelham.	Wilbraham.

District No. 23.

Deputy Charles H. Gehle, Westfield.

Telephone, 843 or 920.

Agawam.
Blandford.
Chester.
Granville.
Huntington.
Montgomery.
Russell.
Southwick.
Tolland.
Westfield.
West Springfield.

District No. 24.

Deputy William W. Sargood, Northampton.

Chesterfield.
Cummington.
Easthampton.
Hatfield.
Goshen.
Holyoke.
Northampton.
Southampton.
Westhampton.
Whately.
Williamsburg.
Worthington.

District No. 25.

Deputy Lyman E. Ruberg, Greenfield.

Telephone, 376–R.

Ashfield.
Bernardston.
Buckland.
Deerfield.
Gill.
Greenfield.
Hawley.
Charlemont.
Colrain.
Conway.
Heath.
Leyden.
Plainfield.
Shelburne.

District No. 26.

Deputy Arthur M. Nichols, North Adams.

Telephone, 391–12.

Adams.
Cheshire.
Clarksburg.
Florida.
Hancock.
Lanesborough.
Monroe.
New Ashford.
North Adams.
Rowe.
Savoy.
Williamstown.
Windsor.

District No. 27.

Deputy Fred R. Zeigler, Pittsfield.

Telephone, 362–11.

Becket.
Dalton.
Hinsdale.
Lee.
Lenox.
Middlefield.
Peru.
Pittsfield.
Richmond.
Stockbridge.
Washington.
West Stockbridge.

District No. 28.

Deputy DeWitt Smith, Great Barrington.

Telephone, 72–6.

Alford.
Egremont.
Great Barrington.
Monterey.
Mount Washington.
New Marlborough.
Otis.
Sandisfield.
Sheffield.
Tyringham.

[B.]

List of Commissioners.

United States Bureau of Fisheries, Washington, D. C.

George M. Bowers, Commissioner.
Hugh M. Smith, Deputy Commissioner.
Irving H. Dunlap, Chief Clerk.
R. S. Johnson, Assistant in Charge of Division of Fish Culture.
Barton W. Everman, Assistant in Charge of Division of Inquiry Respecting Food Fishes.
A. B. Alexander, Assistant in Charge of Division of Statistics and Methods of the Fisheries.
Hector Von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.
Charles G. Atkins, Craig Brook, East Orland, Me.
E. E. Hahn, Boothbay Harbor, Me.
W. F. Hubbard, Nashua, N. H.
E. N. Carter, St. Johnsbury, Vt.
C. G. Corliss, Gloucester, Mass.
E. F. Locke, Woods Hole, Mass.
Chester K. Green, Cape Vincent, N. Y.
L. G. Harron, Washington, D. C.
George A. Seagle, Wytheville, Va.
R. K. Robinson, White Sulphur Springs, W. Va.
H. D. Aller, Beaufort, N. C.
J. J. Stranahan, Cold Springs, Bullochville, Ga.
James A. Henshall, Tupelo, Miss.
W. E. Morgan, Edenton, N. C.
A. G. Keesecker, Fishery, Tenn.
S. W. Downing, Put-in-Bay, O.
S. P. Wires, Duluth, Minn.
S. P. Bartlett, Quincy, Ill.
M. F. Stapleton, Manchester, Ia.
G. W. U. Brown, Homer, Minn.
W. O. Buck, Neosho, Mo.
J. L. Leary, San Marcos, Tex.

G. G. Ainsworth, Leadville, Col.
D. C. Booth, Spearfish, S. D.
H. D. Dean, Bozeman, Mont.
G. H. Lambson, Baird, Cal.
Henry O'Malley, Clackamas, Ore.
A. H. Dinsmore, Baker Lake, Wash.
W. K. Hancock, Yes Bay, Alaska.
S. G. Worth, Mammoth Spring, Ark.
C. P. Henkle, Afognak, Alaska.
R. E. Coker, Fairport, Ia.

Alabama.

Game and Fish Commissioner.

John H. Wallace, Jr., ... Montgomery.

Arizona.

Fish and Game.

W. L. Pinney, Secretary, ... Phœnix.
V. V. Merino, ... Flagstaff.
Theo. T. Swift, ... Safford.

California.

Fish and Game Commission, San Francisco.

M. J. Connell, President, ... Los Angeles.
David Starr Jordan, ... Stanford.
F. G. Sanborn, ... San Francisco.
John P. Babcock, Chief Deputy, ... San Francisco.

Colorado.

State Game and Fish Commission.

Thomas J. Holland, Commissioner, ... Denver.
R. L. Spargur, Chief Clerk, ... Denver.
W. E. Patrick, Superintendent Fish Hatcheries, . Denver.
James A. Shinn, Deputy Commissioner, . . . Denver.

Connecticut.

George T. Mathewson, President, ... Thompsonville.
E. Hart Geer, Secretary, ... Hadlyme.
E. Hart Fenn, ... Wethersfield.

Delaware.

Game Protective Association.

A. D. Poole, President, ... Wilmington.
E. G. Bradford, Jr., Secretary and Treasurer, . . Wilmington.

Florida.

Honorary Fish Commissioner.

John Y. Detwiler, ... New Smyrna.

Georgia.

Fish Commissioner.

A. T. Dallis, ... LaGrange.

Idaho.

Fish and Game Department.

William N. Stephens, State Game Warden, . . Boise.
B. T. Livingston, Chief Deputy, ... Boise.

Illinois.

State Game Commissioner.

John A. Wheeler, ... Springfield.

Board of Fish Commissioners.

Nat H. Cohen, President, ... Urbana.
S. P. Bartlett, Secretary, ... Quincy.
Henry Kleine, ... Chicago.

Indiana.

George W. Miles, Commissioner, ... Indianapolis.
R. D. Fleming, Chief Deputy, North, ... Fort Wayne.
Jacob Sottong, Chief Deputy, South, ... Brookville.

Iowa.

State Fish and Game Warden.

George A. Lincoln, 234 Granby Block, . . . Cedar Rapids.

Kansas.

L. L. Dyche, ... Pratt.

Louisiana.

Board of Commissioners for the Protection of Birds, Game and Fish.

Frank M. Miller, President, ... New Orleans.
Fred J. Grace, Register of State Land Office, . . Baton Rouge.
Prof. W. R. Dodson, Director, State Experiment Stations, ... Baton Rouge.

Maine.

Inland Fisheries and Game.

J. W. Brackett, Chairman,	Phillips.
Blaine S. Viles,	Augusta.
Edgar F. Ring,	Orono.

Sea and Shore Fisheries.

James Donahue, Commissioner,	Rockland.

Maryland.

Board of Shellfish Commissioners.

Walter J. Mitchell, Chairman,	La Plata.
Benjamin K. Green, Treasurer,	Westover.
Dr. Caswell Grave, Secretary,	Baltimore.

State Fishery Force.

T. C. B. Howard, Commander,	Annapolis.

State Game Warden.

Horace F. Harmonson,	Berlin.

Fish Commissioners.

Samuel J. Twilley,	Pocomoke City.
John H. Wade,	Boonsborough.

Massachusetts.

Commissioners on Fisheries and Game.

George W. Field, Chairman,	Boston.
John W. Delano,	Marion.
George H. Garfield,	Brockton.

Michigan.

Fish Commissioners.

Charles D. Joslyn, President,	Detroit.
Delbert H. Power, Vice-President,	Sutton's Bay.
Fred Postal,	Detroit.

State Game, Fish and Forestry Warden.

Charles S. Pierce,	Lansing.
Charles N. Smith, Chief Deputy,	Petoskey.

Minnesota.

Game and Fish Commissioners.

Robert Hannah, President,	Fergus Falls.
George J. Bradley, First Vice-President,	Norwood.
O. J. Johnson, Second Vice-President,	Glenwood.
Joseph A. Wessel, Secretary,	Crookston.
H. A. Rider, Executive Agent,	Little Falls.

Missouri.

Fish Commissioners.

L. A. Geserich, President,	St. Louis.
Ed. Lee,	St. Louis.
W. S. Willard, Secretary,	St. Joseph.
Ed. Willoughby,	Windsor.
Richard Porter,	Paris.

State Game and Fish Commissioner.

Jesse A. Tolerton,	Jefferson City.

Montana.

State Game and Fish Warden.

Henry Avare,	Helena.
D. H. Morgan, Chief Deputy,	Helena.

Nebraska.

Game and Fish Commission.

A. P. Shallenberger, Governor, and ex officio Game and Fish Commissioner,	Lincoln.
Dan Geilus, Chief Deputy Game and Fish Commissioner,	Lincoln.
W. J. O'Brien, Superintendent of Hatcheries,	Gretna.
Joe Benkler, Deputy Warden,	Lincoln.
Isaac King, Deputy Warden,	Superior.
John E. Donovan, Deputy Game Warden,	Lincoln.

Nevada.

Fish Commission.

George T. Mills,	Carson.
E. B. Yerington,	Carson.
James Clark,	Reno.

New Hampshire.

Nathaniel Wentworth, Chairman,	Hudson Centre.
Charles B. Clarke,	Concord.
Frank P. Brown,	Whitefield.

New Jersey.

Fish and Game Commissioners.

B. C. Kuser, President,	Trenton.
William A. Logue, Treasurer,	Bridgeton.
Percival Chrystie,	High Bridge.
Ernest Napier,	East Orange.
Walter H. Fell, Secretary,	Trenton.

New Mexico.

Game and Fish Warden.

Thomas P. Gable, Territorial Game and Fish Warden,	Santa Fé.
Willi G. Fischer, Chief Deputy Game and Fish Warden,	Santa Fé.

New York.

Forest, Fish and Game Commission.

Thomas S. Osborne, Commissioner.
John B. Burnham, Deputy Commissioner.
John D. Whish, Secretary.
Llewellyn Legge, Chief Game Protector.
Office, State Capitol, Albany, N. Y.

Bureau of Marine Fisheries.

Clinton S. Dixon, Deputy State Superintendent of Marine Fisheries.
Charles Wyeth, Engineer and Surveyor.
Office, 1 Madison Avenue, New York City.

North Carolina.

Dr. R. H. Lewis,	Raleigh.
T. Gilbert Pearson,	Greensboro.

North Dakota.

Game and Fish Board of Control.

Herman Winterer, President,	Valley City.
J. L. Killion, Vice-President,	Towner.
D. I. Armstrong, Secretary,	Willow City.
J. B. Eaton,	Fargo.
Thomas Griffiths,	Grand Forks.
W. N. Smith, Chief Game Warden, District No. 1,	Grafton.
Olaf Bjorke, Chief Game Warden, District No. 2,	Abercrombie.

Ohio.

Commissioners of Fish and Game.

Paul North, President,	Cleveland.
Thomas B. Paxton,	Cincinnati.
J. F. Rankin,	South Charleston.
D. W. Greene,	Dayton.
George W. McCook,	Steubenville.
George C. Blanckner, Secretary,	Columbus.
J. C. Speaks, Chief Warden,	Columbus.

Oklahoma.

State Game and Fish Warden.

Lon Frame,	Ardmore.

Oregon.

Department of Fisheries.

R. E. Clanton, Master Fish Warden,	Salem.

State Game and Forestry Warden.

R. O. Stevenson,	Forest Grove.

Pennsylvania.

Department of Fisheries.

W. E. Meehan, Commissioner of Fisheries,	Harrisburg.

Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phœnixville.
W. A. Leisenring,	Mauch Chunk.

Game Commissioners.

Dr. Charles B. Penrose, President,	Philadelphia.
C. K. Sober,	Lewisburg.
John M. Phillips,	Pittsburg.
Arthur Chapman,	Doylestown.
William B. McCaleb,	Harrisburg.
Lanning Harvey,	Wilkes-Barre.
Dr. Joseph Kalbfus, Secretary,	Harrisburg.

Rhode Island.

Commissioners of Inland Fisheries.

Charles W. Willard, President,	Westerly.
William H. Boardman, Vice-President,	Central Falls.
Adelbert H. Roberts, Auditor,	Woonsocket.
Isaac H. Clarke, Treasurer,	Jamestown.
Daniel B. Fearing,	Newport.
William P. Morton, Secretary,	Providence.

Commissioners of Shellfisheries.

Philip H. Wilbour, Chairman,	Little Compton.
John H. Northup,	Apponaug.
Edward Atchison,	Slatersville.
Samuel F. Bowden,	Barrington.
John G. Wilcox,	Westerly.

Commissioners of Birds.

C. E. Pierce, Chairman,	East Providence.
W. Gordon Reed, 2d,	Providence.
Edwin R. Lewis, M.D.,	Westerly.
W. H. Thayer,	Bristol.
C. M. Hughes,	Newport.

Tennessee.

State Warden.

Joseph H. Acklen,	Nashville.

Texas.

Game, Fish and Oyster Commission.

R. H. Wood,	Rockport.

Utah.

Fred W. Chambers,	Salt Lake City.

Vermont.

John W. Titcomb,	Lyndonville.

Virginia.

Commission of Fisheries.

W. McDonald Lee, Commissioner,	Irvington.
S. Wilkins Matthews, Secretary,	Oak Hall.
George B. Keezell,	Keezeltown.
Bland Massie,	Tyro.
J. M. Hooker,	Stuart.
Edward L. C. Scott, Clerk,	Richmond.

Washington.

Fish Commissioner and Game Warden Ex Officio.

John L. Riseland,	Bellingham.

West Virginia.

Forest, Game and Fish Warden.

J. A. Viquesney, Warden,	Belington.
W. B. Rector, Chief Deputy,	Belington.
H. M. Lockridge, Chief Deputy,	Belington.

Wisconsin.

Fish and Game Warden Department.

George W. Rickeman, State Fish and Game Warden,	Madison.
J. F. Sugden, Chief Deputy,	Madison.

Commissioners of Fisheries.

The Governor, ex officio.	
Jabe Alford, President,	Madison.
George B. Hudnall, Vice-President,	Superior.
E. A. Birge,	Madison.
James J. Hogan,	LaCrosse.
William J. Starr,	Eau Claire.
A. A. Dye,	Madison.
A. L. Osborn,	Oshkosh.
James Nevin, Superintendent of Fisheries,	Madison.

Wyoming.

State Game Warden.

D. C. Nowlin,	Lander.

[C.]

Distribution of Food Fish.

Trout Fry.

Distribution of Trout Fry from the Adams Hatchery during April and May, 1910.

Applicant.	Town.	Name of Brook.	Number.
Chester E. Gleason,	Pittsfield,	Sackett,	5,000
Stacy Oliver,	Pittsfield,	Schoolhouse,	5,000
Frank W. Rice,	Lanesborough,	Hancock,	5,000
William H. Newton,	Lanesborough,	Hancock,	5,000
C. R. St. James,	Lanesborough,	Allen,	5,000
Henry A. Root,	Hancock,	Hancock,	5,000
O. C. Bidwell,	Monterey,	Old Carter,	5,000
Samuel Newell,	Great Barrington,	Tributary to Alford,	5,000
John M. Maloney,	Great Barrington,	Green,	5,000
Henry W. Scott,	Great Barrington,	Green,	5,000
Homer E. Foote,	Great Barrington,	Seekonk,	5,000
Orlando S. Fish,	Pittsfield,	Rice,	5,000
James M. Seavey,	Pittsfield,	Sachem,	5,000
Joseph L. White,	Lanesborough,	Town,	5,000
H. J. Couch,	Lanesborough,	Rice,	5,000
James M. Downes,	Hancock,	Hancock,	5,000
W. E. Foster,	-	-	5,000
Walter G. Wood,	Huntington,	Woodruff,	5,000
H. J. Coughlin,	North Adams,	Sherman, Tunnell,	15,000
H. J. Coughlin,	Clarksburg,	North Branch,	
Harry J Sheldon,	Adams,	Bassett,	10,000
J. E. Morgan,	Adams,	Tophet,	5,000
John McCormick,	Windsor,	Tyler,	5,000
Harry J. Stetson,	Plainfield,	Stetson,	5,000
Robert Groves,	Savoy,	Bear,	5,000
D. E. Burnett,	Savoy,	Perkins,	5,000
James G. Bennett,	Cheshire,	Pettibone,	5,000
George McAuley,	Cheshire,	Mason,	5,000
Bradley C. Newell,	Rowe,	Newell Farm,	5,000
L. I. Brown,	Rowe,	Brown,	5,000
Ide Brown,	Rowe,	Hunt,	5,000
Arthur M Nichols,	North Adams,	Tunnell,	5,000
Arthur M. Nichols,	Clarksburg,	North Branch,	
Pittsfield Fish and Game Association,	Pittsfield,	Angler's Club Pond,	25,000
			195,000

Fry distributed from the Hadley Hatchery during March and April, 1910.

Herbert W. Gould,	Athol,	Newton,	5,000
Harry A. Bancroft,	Athol,	Newton,	5,000
Arthur W. Stevens,	Athol,	Ellinwood,	5,000
W. S. Ellinwood,	Athol,	Ellinwood,	5,000

Fry distributed from the Hadley Hatchery, etc. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
James W. Boutell,	Athol,	Riceville,	5,000
H. S. Weston,	Athol,	Ellinwood,	5,000
Foster A. Caples,	Athol,	– – – –	5,000
E. B. Newton,	Athol,	Popple Camp,	5,000
Anson R. Tolman,	Phillipston,	Newton,	5,000
Claude R. Edgerly,	Athol,	Collar,	5,000
Joseph Hamel,	Boylston,	Greeley,	5,000
Oakley Whitney,	Petersham,	Popple Camp,	5,000
George W. Boutell,	Athol,	Newton,	5,000
W. L. Pitcher,	Westhampton,	Manhan River,	5,000
D. Scott Low,	Westhampton,	Manhan River (north branch),	5,000
J. A. Miller,	Easthampton,	Parsons,	5,000
Edw. L. Schmidt,	Belchertown,	Jabish,	5,000
M. W. Smith,	Goshen,	Rogers,	5,000
John Doherty,	Goshen,	Highland,	5,000
W. A. Smith,	Goshen,	Highland,	5,000
F. E. Hawks,	Goshen,	Packard,	5,000
John N. Moore,	Orange,	Cheney,	5,000
W. H. Gale,	Orange,	Goddard,	5,000
William Boyle,	Shelburne Falls,	Catamount,	5,000
E. M. Gould,	Shelburne Falls,	Long,	5,000
Arthur B. Harlow,	Easthampton,	Bassett,	5,000
Leon N. Baldwin,	Easthampton,	Hannum's,	5,000
Wilfred Laro,	Easthampton,	Hannum's,	5,000
Henry C. Davis,	Ware,	Bonn,	5,000
Stedman W. Coe,	Hardwick,	Newton,	5,000
E. L. Parker,	Coldbrook,	Coldbrook Stream,	5,000
Herbert E. Tyler,	Kendal Green,	Hobbs,	5,000
Winfield F. Rowe,	Weston,	Devil's Den,	5,000
George E. Warren, Jr.,	Waltham,	Pequod,	5,000
Elvin J. Hoffses,	Wayland,	Schoolhouse,	5,000
Charles F. Mills,	Wayland,	Pequod,	5,000
Dennis F. Shea,	Ware,	Flat,	5,000
			185,000

Fry distributed from the Sutton Hatchery during April and May, 1910.

William T. Sweet,			
E. L. Douglass,			
C. A. Kilburne,			
Frank Grant,			
W. S. Marsh,	Westfield,	Powder Mill, Jack's,	45,000
L. H. Bowers,			
R. C. Hollister,			
C. F. Bowers,			
John M. Sauter,			
A. W. Pratt,	Gardner,	Mosquito,	5,000
W. A. Streeter,	Gardner,	Hosmer,	5,000
E. L. Knowlton,	Gardner,	Poor Farm,	5,000
S. W. Rogers,	Phillipston,	Brigham,	5,000
H. L. Curtis,	Gardner,	Bailey,	5,000
C. Fred Morse,	Gardner,	Wilder,	5,000
H. G. Howard,	Ashburnham,	Cooper,	5,000
F. A. Gravlin,	Ashburnham,	Black,	5,000
John Gibson,	Lancaster,	Slate Rock,	10,000
Archie McKean,		Burke's, Shoeshank,	
Horace H. Ramsey,	Orange,	Swift River,	5,000
A. P. Morin,	North Brookfield,	Rothwell, Mad, Snow,	15,000
Elmer A. Macker,	North Grafton,	Sheehan, Carroll, Bummit,	15,000
C. L. Allen,	Worcester,	Barber,	5,000
Henry E. Dean,	Worcester,	Lincoln,	5,000
Henry W. Carter,	Millbury,	Sutton,	5,000
W. F. Durgin,	Mendon,	Muddy,	5,000
J. S. Hubbard,	Fiskdale,	Clay,	5,000
Henry H. Hallock,	Hubbardston,	Prentice,	5,000
Charles C. Kinch,	Chelmsford,	Golden Cove,	5,000
Charles E. Blaisdell,	Lowell,	Flag Meadow,	5,000
Willis S. Holt,	West Andover,	Hardy's,	5,000
Fred E. Jones,	Tyngsborough,	Flint,	5,000

Fry distributed from the Sutton Hatchery, etc. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
S. J. Bigelow,	North Chelmsford,	Swan's,	5,000
George W. Alcott,	Chelmsford,	Black,	5,000
John H. Seifer,	Westford,	Vine,	5,000
Henri E. Richardson,	Westford,	Snake Meadow,	5,000
H. A. MacDonald,	Beverly Farms,	Onion,	5,000
C. A. Currier,	Lexington,	Concord Avenue,	5,000
N. J. Hardy,	– –	– – –	5,000
O. W. Whittemore,	– –	– – –	5,000
Walter Baker,	Woburn,	Hall's,	5,000
C. E. Taylor,	– –	– – –	5,000
R. H. Magee,	– –	– – –	5,000
D. F. McIntosh,	– –	– – –	5,000
David G. Whelton,	Danvers,	Turnpike,	5,000
George M. Sinclair,	Middleton,	Blind,	5,000
F. S. Burke,	Danvers,	Nichols, Frost,	5,000
Richard L. Everit,	Wellesley Farms,	Indian Spring,	5,000
Nathan B. Everett,	Assonet,	Ledge,	5,000
Joseph Rudolph,	Norton,	Birch,	5,000
Dana C. Everett,	Assonet,	Ledge,	5,000
J. J. Kennedy,	Stoughton,	Dead Meadow,	5,000
Jefferson Jones,	Stoughton,	Cedar,	5,000
William H. Brown,	Royalston,	Whitney,	5,000
Marcus A. Young,	Royalston,	Loud,	5,000
Arthur L. Brown,	Royalston,	Stockwell,	5,000
Archie C. Towne,	Royalston,	Stockwell,	5,000
Charles T. Brown,	Royalston,	Loud,	5,000
Fitchburg Sportsmen's Club,	Fitchburg,	Ashburnham,	10,000
	Townsend,	Lord,	15,000
Daniel H. Rice,	Barre,	Tansey Meadow,	10,000
Fred Field,	Montague,	Cold,	5,000
R. L. Clapp,	Montague,	Pond,	10,000
O. E. Bradway,	Monson,	Bates and Conant,	10,000
Frank R. Sutcliffe,	Monson,	Sykes and Sutcliffe,	10,000
W. M. Baker,	New Salem,	Holden,	5,000
W. M. Baker,	Warwick,	Darling,	5,000
R. T. Shumway,	New Salem,	Porters,	10,000
A. T. Mitten,	– –	– – –	10,000
George S. Baker,[1]	Rehoboth,	Upper branch Palmer River,	10,000
R. W. Briggs,	Merrimac,	Attitash,	10,000
F. W. Read,	Middleborough,	Josie, Ford, Fall,	15,000
Brockton Fish and Game Association,	Bridgewater,	Sturtevant's,	15,000
Leominster Sportsmen's Association,	Leominster-Shirley,	Heywood, Tophet,	15,000
Fred Field,	Montague,	Cold,	5,000
W. E. Smith,[1]	North Chester,	Middle branch Westfield River,	20,000
James E. Bemis,[1]	Wellesley,	Fuller,	15,000
James E. Bemis,[1]	Needham,	Trim,	15,000
James E. Bemis,[1]	Newton,	Farm,	150,000
			545,000

Fingerling Trout Plants during Fall of 1910.

Edw. L. Knowlton,	Gardner,	Poor Farm,	500
S. W. Rogers,	Gardner,	Brigham,	500
A. W. Pratt,	Gardner,	Bailey,	500
H. L. Curtis,	Gardner,	Bailey,	500
Myron R. Goddard,	Gardner,	Hubbardston,	500
H. O. Bateman,	– –	– – –	500
Charles T. Brown,	Winchendon,	Belknap,	500
Levi F. Martin,	Winchendon,	Beaman,	500
W. H. Perry,	Winchendon,	Bailey,	500
Levi P. Ball,	Winchendon,	Beals,	500
H. A. Haywood,	Royalston,	Stockwell,	500
Marcus A. Young,	Winchendon,	Stockwell,	500
Archie C. Towne,	Winchendon,	Stockwell,	500
William H. Brown,	Winchendon,	Beaman,	500
A. L. Brown,	Winchendon,	Stockwell,	500
H. L. Howard,	Ashburnham,	Cooper,	500

[1] Obtained brown trout fry.

Fingerling Trout Plants during Fall of 1910 — Continued.

Applicant.	Town.	Name of Brook.	Number
Frank A. Gravlin,	Ashburnham,	Black,	500
William P. Wharton,	Groton,	Hunkerty,	1,000
F. J. Piper,	Townsend,	Stickney,	500
F. J. Knight,	Townsend,	Stickney,	500
F. L. Hager,	Baldwinville,	Brigham, Bourn and Hadley,	500
F. L. Newton,	Baldwinville,	Trout,	500
J. D. Mason,	Baldwinville,	Fenno,	500
M. H. Gleason,	Baldwinville,	Norcross,	500
J. H. Whitcomb,	Littleton,	Beaver,	500
Albert H. Sherman,	Harvard,	Hell Pond,	500
Edward S. Cook,	Norfolk,	Mann,	500
F. P. Searle,	Norfolk,	Cress,	500
J. N. Blanchard,	Franklin,	Paine's Pond,	500
H. A. Besse,	Franklin,	Cress,	500
Leominster Sportsmen's Association, Charles F. McCarthy, Francis W. Leary,	Lunenburg,	Lunenburg, Fort Meadow,	3,000
James H. McGarry, George A. Greene, Andrew L. Morgan,	Marlborough,	Flag, Bartlett,	2,500
Sutton Hatchery,	– –	– – –	2,000
Silas Hatch,	Falmouth,	Child's River,	1,000
Charles S. Baker,	Falmouth,	Coonamessitt,	1,000
James Heyes,	Westport,	Kirby,	1,000
Joseph Rudolph,	Taunton,	Bird, Segregansett,	1,000
James Burke,	South Westport,	Cornell,	1,000
Thomas Taylor,	Westport,	Bread and Cheese,	1,000
Frank W. Read,	Middleborough,	Fall, Josie Meadow,	1,000
Roland M. Keith,	Bridgewater,	Mill,	1,000
J. H. Tower,	Rockland,	Plyer and Molly,	1,000
W. Scott Edson,	Scituate,	Tack Factory, Spring,	1,000
F. M. Draper,	Norton,	Doris, Tucker,	1,000
R. W. Leonard,	Foxborough,	McAvoy,	1,000
Alton S. Brown,	Foxborough,	Rumford River,	1,000
John T. Robinson,	Hyde Park,	Pine Tree,	1,000
Charles L. McMahon,	Randolph,	Blue Hill,	1,000
J. J. Kennedy,	Stoughton,	Dead Meadow,	1,000
Reymund E. Warren,	– –	– – –	1,000
Frank B. Twitchell,	Natick,	Nobscot, Brackett's,	1,000
Charles N. Hargraves,	Framingham,	Rattlesnake, Sucker, Angelica,	1,000
Edward Babson,	Rockport,	Stony,	1,000
W. H. Gee,	Rockport,	Wine,	1,000
R. W. Briggs,	Amesbury,	Attitash,	1,000
Charles H. Preston,	Topsfield,	Elliott,	1,000
Herman A. MacDonald,	Beverly Farms,	Onion River,	1,000
D. G. Whelton,	Salem,	Poor,	1,000
Edgar P. Sellew,	Billerica,	Webb,	1,000
C. A. Currier,	Lexington,	Dunn's,	1,000
Charles F. Nourse,	Lexington,	Shawsheen,	1,000
O. W. Whittemore,	– –	– – –	1,000
N. J. Hardy,	– –	– – –	1,000
E. J. Hoffses,	Weston,	Cherry,	500
A. Grip,	Weston,	Allen,	500
Bernard W. Stanley,	Weston,	Allen,	500
Thomas H. Bruce,	Weston,	Cherry,	500
Henry H. Watson,	Weston,	Allen,	500
Frank H. Haron,	Weston,	Cherry,	500
Gardiner H. Fiske,	Weston,	Cherry,	500
John A. Barton,	Ashby-Townsend,	Pearl Hill,	3,000
Greenfield Sportsmen's Association,	Greenfield,	Green River,	2,000
Fred E. Field,	Montague,	Cold Brook,	400
R. L. Clapp,	Montague,	Pond,	400
Charles H. Sawyer,	Hatfield,	Roaring,	400
N. P. Farwell,	Turners Falls,	Fall River,	400
Frederick Spencer, Louis Vici, A. Schempp, John Conners,	Buckland,	Deerfield River,	1,600
W. C. Thompson,	Buckland,	Avery,	400
D. E. Benjamin,	– –	– – –	400
J. Phelps,	– –	– – –	400
A. G. Moody,	– –	– – –	400

Fingerling Trout Plants during Fall of 1910 — Continued.

Applicant.	Town.	Name of Brook.	Number.
Bradley C. Newell,	Rowe,	Newell Farm,	400
E. A. Pike,	Rowe,	Hunt,	400
J. N. Moore,	Orange,	Cheney,	400
W. H. Gale,	Orange,	Jones,	400
R. T. Shumway,	New Salem,	Poole River,	400
H. H. Ramsey,	New Salem and Warwick,	Gale and Cheney,	400
W. M. Baker,	Warwick,	Darling,	400
J. W. Boutell,	Athol,	Riceville,	200
A. W. Stevens,	– –	– – –	200
E. B. Newton,	– –	– – –	200
W. S. Ellinwood,	Athol,	Ellinwood,	200
B. W. Streeter, Jr.,	Athol,	West,	200
Joseph Hamel,	Royalston,	Nancy Whipple,	200
C. R. Edgerly,	Athol,	Greeley,	200
J. L. Pelkey,	– –	– – –	400
A. P. Rice,	Athol,	Nelson,	200
G. A. Caples,	– –	– – –	200
J. L. Powers,	– –	– – –	400
Louis H. Ruggles,	Furnace,	Moose,	400
W. E. Davis,	Winchendon,	Priest,	400
H. H. Hallock,	Hubbardston,	Prentiss,	400
W. M. Tourtelott,	Prescott,	West branch Swift River,	400
H. E. Brown,	North Dana,	Powers,	400
G. W. Durkee,	Dana,	Blackmer,	400
J. E. Sweetland, E. J. Brannigan,	Dana,	Blackmer,	400
B. W. Buckley, J. H. Neff,	Ware,	Muddy, Flat,	1,200
A. T. Mitten,	– –	– – –	400
John Corsa,	– –	– – –	400
A. H. Dakin,	– –	– – –	400
J. F. Page,	– –	– – –	400
J. O. Thompson,	– –	– – –	400
N. E. Augur,	– –	– – –	400
D. S. Low,	Easthampton,	Bassett,	400
W. L. Pitcher,	Easthampton,	Bassett, Sawyer,	400
J. A. Miller,	Easthampton,	Manhan,	400
E. R. Alvord,	Easthampton,	Pomeroy,	400
Northampton Rod and Gun Club,	Easthampton, Hatfield, Northampton,	Parsons, Broad, Running Gutter,	2,000
A. J. Polmatin,	Williamsburg,	Mill River,	400
M. S. Howes,	Cummington,	Willcutt,	400
W. E. Pillinger,	Williamsburg,	Ashfield,	400
F. L. Bisbee,	Williamsburg,	North branch Mill River,	400
F. A. Shumway,	Williamsburg,	Bradford,	400
M. E. Story,	– –	– – –	400
E. A. Woodward,	– –	– – –	400
H. A. Buzzell,	Longmeadow,	Pecowsie,	400
A. D. Prouty,	– –	– – –	400
R. L. Smith,	Hampden,	Scantic River,	400
Ira J. Humes,	Holyoke,	Batchelor,	800
J. M. Eddy,	Enfield,	Sunk,	400
Stevens Rod and Gun Club,	Chicopee Falls,	Cooley, Williams,	1,000
Westfield Fish and Game Club,	Westfield,	Sandy Mill,	2,000
A. D. Norcross,	Monson,	Conant,	400
H. T. Moulton,	Wales,	Conant,	400
W. M. Peck,	Wales,	Conant,	400
S. D. Sherwood,	Wales,	Conant,	400
North Brookfield Fish and Game Association,	North Brookfield,	Webb, Harrington,	1,000
J. F. Stone,	Sturbridge,	Walker Pond,	400
F. T. Bullard,	Sturbridge,	Great,	400
W. E. Holland,	Brimfield,	Quoboag River,	1,200
G. H. Wilson,	Spencer,	New Pond,	400
Dr. A. E. Snow,	Spencer,	Wilson,	400
H. S. Tripp,	Spencer,	Thompson,	400
C. E. Bill,	West Brookfield,	Sucker,	200
W. E. Sibley,	West Brookfield,	Tanney, Bassett,	200
N. C. Capen,	Spencer,	Meadow,	400
A. D. Putnam,	– –	– – –	400

Fingerling Trout Plants during Fall of 1910 — Concluded.

Applicant.	Town.	Name of Brook.	Number.
C. C. Dodge,	Shrewsbury,	Bullard,	400
H. E. Dean,	Worcester,	Lincoln,	400
George P. King,	– –	– – –	400
R. E. Howard,	– –	– – –	400
Norton Company,	Worcester,	Barber,	400
Clinton Rod and Gun Club,	Clinton,	Collins, Clamshell,	1,000
A. G. Chickering,	Bolton,	Hillside,	400
L. F. Cobb,	– –	– – –	400
W. F. Hosmer,	South Sudbury,	Chub,	400
H. M. Plimpton,	Sutton,	Mill,	400
G. A. Moo,	– –	– – –	400
H. W. Carter,	Millbury,	No Name,	400
E. A. Macker,	North Grafton,	Bummit, Shahan,	1,200
E. C. Traver,	– –	– – –	400
H. D. Aldrich,	– –	– – –	400
I. P. Taft,	– –	– – –	400
B. E. Aldrich,	Milford,	Braggville,	400
Dr. P. E. Joslin,	Hopedale,	Muddy Pond,	400
W. F. Durgin,	Mendon,	Muddy,	400
A. F. Johnson,	– –	– – –	400
C. A. Reynolds,	Sutton,	Stevens,	400
W. R. Wallis,	East Douglas,	Centerville,	400
E. P. Heath,	East Douglas,	Centerville, Howell,	400
P. S. Callahan,	Fiskdale,	Hyland,	400
J. P. Siddall,	Sturbridge,	Hinman,	400
C. R. Kelley,	Sturbridge,	Hobbs,	400
Fred Quinn,	Fiskdale,	Cooper,	400
E. D. Atkins,	Uxbridge,	Cold Spring,	400
C. B. Adams,	Webster,	Sucker, Brown,	1,200
H. P. Coughlin,	– –	– – –	2,000
W. P. Martin,	Adams,	Bassett,	400
R. A. Roehm,	Adams,	Dean,	400
W. N. Nye,	– –	– – –	400
P. E. Powers,	Adams,	Miller,	400
H. H. Fitzroy,	Savoy Center,	Town Hall,	400
Michael Clancy,	– –	– – –	400
P. H. Callahan,	Cheshire,	Needham,	400
Francis O'Neill,	Cheshire,	Kitchen, McDonald,	400
Pittsfield Anglers' Club,	Pittsfield,	Yokum, Sackett,	2,000
Dr. A. L. Boudreau,	Becket,	Cole,	400
J. N. Pelkey,	Middlefield,	Coldbrook,	400
George F. Blood,	West Stockbridge,	Mack,	400
A. Silvernail,	West Stockbridge,	Mack,	400
J. L. Hover,	West Stockbridge,	Flat,	400
Thomas S. Clarke,	Lenox,	Farm,	1,000
H. E. Foote,	Great Barrington,	Green River,	400
J. A. Verchot,	New Boston,	Balch, Thorp,	400
H. S. Manley,	Montville,	Morley, Reservoir,	400
J. G. Stevens,	Great Barrington,	Stevens,	400
George W. Greene,	New Marlborough,	Konkapot,	400
Samuel Newell,	Great Barrington,	Alford,	400
C. M. Gibbs,	Great Barrington,	Green River,	400
			123,500

Ponds stocked and closed in Accordance with Chapter 91, Section 19, Revised Laws, as amended by Chapter 274, Acts of 1903, and further amended by Chapter 306, Acts of 1907.

Name of Pond.	Town.	Brown Trout Fingerlings.	White Perch.
Muddy,	Kingston,	1,000	–
White,	Athol,	1,000	–
Russell,	Russell,	1,000	–
Fresh,	Dennis,	–	121
Attitash,	Amesbury,	1,000	–
Pelham,	Wayland,	1,000	–
Little Chauncy,	Northborough,	1,000	–
Little Herring,	Plymouth,	1,000	–
Scaddings,	Taunton,	1,000	–
Indian Head,	Pembroke,	1,000	–
		9,000	121

Waters stocked without Further Action during 1910.

Name of Waters.	Town.	White Perch.	Brown Trout Fingerlings.
Whalom Lake,	Lunenburg,	432	–
Long Pond,	Lakeville,	242	–
Shawsheen River,	Billerica,	301	–
Nabnasset,	Westford,	281	–
Harris,	Methuen,	186	–
Jamaica,	Boston,	154	–
Scargo Lake,	Dennis,	–	1,000
		1,596	1,000

[D.]

Distribution of Pheasants.

Applicant.	Town.	Number.
Sigmund Klaiber,	Turners Falls,	12
Dennis E. Farley,	Farley,	12
North Brookfield Fish and Game Association.	North Brookfield,	12
M. C. Needham,	Oakham,	12
John W. Jackson,	Belchertown,	12
Waldo H. Pierce,	Prescott,	12
Charles E. Gee,	North Dana,	12
George W. Alcott,	Lowell,	12
Henry Boynton,	Lowell,	12
C. W. Prescott,	Concord,	12
James P. Stearns,	Brookline,	12
George W. Randall,	Plympton,	12
William J. Wright,	Duxbury,	12
Edw. E. Whiting,	West Upton,	12
Roland M. Keith,	Bridgewater,	12
George R. Sampson,	Middleton,	12
J. A. Barton,	Fitchburg,	12
Homer E. Foote,	Great Barrington,	12
J. G. Stevens,	Great Barrington,	12
Frank W. Rice,	Pittsfield,	12
W. E. Foster,	Lanesborough,	12
Rufus W. Page,	Newburyport,	12
Basil E. Aldrich,	Milford,	12
Arthur LeB. Treen,	West Medway,	12
Walter F. Durgin,	Hopedale,	12
Willis L. Colson,	Boston,	12
P. S. Callahan,	Fiskdale,	12
E. D. Atkins,	Uxbridge,	12
W. R. Wallis,	East Douglas,	12
A. L. Nickerson,	Dedham,	12
E. W. Grew,	Boston,	12
George H. Doty,	Waltham,	12
S. G. Tenney,	Williamstown,	12
Humphrey J. Coughlin,	North Adams,	12
H. H. Whitcomb,	Littleton,	12
Frank J. Knight,	Townsend,	12
Charles F. Cooper,	Springfield,	12
Frank S. Eaton,	Springfield,	12
George Brimicomb,	Shrewsbury,	12

Distribution of Pheasants — Concluded.

Applicant.	Town.	Number.
Thomas W. Lynch,	Sterling,	12
Henry E. Dean,	Worcester,	12
Dennis F. Shea,	Ware,	12
Albert W. Lewis,	Fall River,	12
Melville Anderson,	Fall River,	12
Harrison G. Blake,	Woburn,	12
S. H. Sinclair,	Salem,	12
Ernest J. Varrell,	Marblehead,	12
William C. Bradley,	Rockport,	12
John C. Spring,	West Gloucester,	12
Robert K. Lufkin,	Gloucester,	12
W. Prentiss Parker,	Ipswich,	12
John E. Gibson,	Merrimac,	12
Robert W. Adams,	Chelmsford,	12
Travers D. Carman,	Tolland,	12
C. F. Gifford,	Westport Factory,	4
Joel P. Bradford,	New Bedford,	4
Albert C. Aiken,	Fairhaven,	4
John J. Kennedy,	Stoughton,	4
F. M. Draper,	East Norton,	4
Melvin S. Nash,	Hanson,	4
William P. Melcher,	Waquoit,	4
Howard Marston,	Boston,	4
Leon P. Nourse,	Westborough,	4
John M. Eddy,	Smith's,	4
Raymond S. Smith,	Hampden,	4
J. C. Crombie,	Methuen,	4
		696

[E.]

Distribution of Quail.

Applicant.	Town.	Number.
G. W. Field,	Sharon,	26
E. M. Brastow,	Wrentham,	26
F. O. Long,	North Grafton,	25
H. M. Blackstone, superintendent,	Bridgewater,	26
Everett W. Needham,	Westminster,	26
F. J. Dutcher,	Hopedale,	26
Forest Park,	Springfield,	16
State Hatchery Grounds,	Wilkinsonville,	11
		182

[F.]

Arrests and Convictions.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Mike Konstantynowicz,	New Bedford,	Taking shellfish in violation of section 114, chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and chapter 177, Acts of 1910,	Convicted,	$10 00	
Augustine Cabral,	New Bedford,		Convicted,	10 00	
Manuel Soares,	New Bedford,		Convicted,	10 00	
Charles H. Davis,	Chatham,		Convicted,	5 00	
Manuel Perry,	New Bedford,		Convicted,	10 00	
Odelon Leblanc,	New Bedford,		Convicted,	10 00	
Walter Lutozer,	New Bedford,		Convicted,	10 00	Failed to pay; went to jail.
William Walsh, Jr.,	East Boston,		Convicted,	5 00	
William Walsh, Sr.,	East Boston,		Convicted,	10 00	
John Souza,	New Bedford,		Convicted,	10 00	
Edward Delair,	New Bedford,		Convicted,	10 00	
Frank England,	New Bedford,		Convicted,	10 00	
Elisha Clark,	New Bedford,		Convicted,	10 00	
Manuel Sylvia,	New Bedford,		Convicted,	10 00	
Antone Sylvia,	New Bedford,		Convicted,	10 00	
James Medeiros,	Dartmouth,		Convicted,	10 00	
Manuel Souza,	Dartmouth,		Convicted,	10 00	
Salvador Souza,	Dartmouth,		Convicted,	10 00	
Antone Gaper,	New Bedford,		Convicted,	10 00	
Joseph Gleason,	Dorchester,		Convicted,	5 00	
Alfonso Marino,	Boston,		Convicted,	5 00	
Cologero Marino,	Boston,		Convicted,	5 00	
Wilfred Breault,	New Bedford,		Convicted,	10 00	
Manuel Morris,	New Bedford,		Convicted,	15 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Dennis McGee,	Quincy,	Taking shellfish in violation of section 114, chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and chapter 177, Acts of 1910,	Convicted,	$5 00	
Michael Walsh,	Quincy,		Convicted,	5 00	
Edmond Bergeron, Jr.,	New Bedford,		Convicted,	10 00	Failed to pay; went to jail.
William H. Lawler,	Beachmont,		Convicted,	–	Filed.
William J. Powers,	Beachmont,		Convicted,	–	Filed.
David A. Ross,	Beachmont,		Convicted,	–	Filed.
George Phillips,	Revere,		Discharged,	–	
Alonzo Cook,	Revere,		Convicted,	5 00	
John Campiano,	Dorchester,		Convicted,	5 00	
Carlo Ferretti,	Lynn,		Convicted,	5 00	
Peter Rodgers,	New Bedford,		Convicted,	15 00	
Alphonse Parent,	New Bedford,		Convicted,	15 00	
Joseph Millo,	New Bedford,		Convicted,	15 00	
Joseph Arsenault,	New Bedford,		Convicted,	15 00	
John V. DeCosta,	Fairhaven,		Convicted,	15 00	
Manuel Cruz,	New Bedford,		Convicted,	15 00	
John Millo,	New Bedford,		Convicted,	15 00	
John Gomes,	New Bedford,		Convicted,	15 00	
John Correia,	Fairhaven,		Convicted,	15 00	
Manuel DeCoste,	New Bedford,		Convicted,	15 00	
John Newman,	Hull,		Convicted,	10 00	
Nelson Neilson,	Hull,		Convicted,	10 00	
Peter Lawson,	Hull,		Convicted,	10 00	
James Neilson,	Hull,		Convicted,	10 00	
John Johnson,	Hull,		Convicted,	10 00	
Maurice Neilson,	Hull,		Convicted,	10 00	
Maurice Morrisey,	Hull,		Convicted,	10 00	
Daniel Daly,	Hull,		– –	–	Defaulted; second offence.
Michael Giroward,	New Bedford,		Convicted,	15 00	
Maurice Neilson,	Hull,		Discharged,	–	
J. Tinlson,	Chelsea,		Convicted,	10 00	
Arthur Cabana,	New Bedford,		Convicted,	15 00	Failed to pay; went to jail.
Manuel Mellor,	New Bedford,		Convicted,	15 00	Failed to pay; went to jail.
Joseph Dion,	New Bedford,		Convicted,	15 00	
Charles Cyr,	Fairhaven,		Convicted,	–	Filed.
Manuel Gomes,	New Bedford,		Convicted,	15 00	
Manuel Avila,	New Bedford,		Convicted,	15 00	
William Breault,	New Bedford,		Convicted,	15 00	
Loring M. Austin,	New Bedford,		Convicted,	15 00	

Joseph Mewicz,	New Bedford,	Taking shellfish in violation of section 114, chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and chapter 177, Acts of 1910,	Convicted,	15 00	
Alfred Antoni,	New Bedford,		Convicted,	–	Filed.
Manuel Ferreira,	New Bedford,		Convicted,	15 00	
Alexander Cormier,	New Bedford,		Convicted,	15 00	
Oliver Cormier,	New Bedford,		Convicted,	15 00	
Antone Souza,	New Bedford,		Convicted,	15 00	
John Carson,	New Bedford,		Convicted,	–	Filed.
Frank Coons,	New Bedford,		Convicted,	15 00	
John Teres,	New Bedford,		Convicted,	15 00	
William Lacharette, Jr.,	New Bedford,		Convicted,	–	Filed.
William Lacharette, Sr.,	New Bedford,		Convicted,	–	Filed.
Manuel Brown,	Fairhaven,		Convicted,	15 00	
William S. Staples,	Fairhaven,		Convicted,	15 00	
William H. Westgate,	Fairhaven,		Convicted,	15 00	
Clovice Gannon,	New Bedford,		Convicted,	10 00	
Manuel Damello,	New Bedford,		Convicted,	10 00	
John Carsey,	New Bedford,		Convicted,	20 00	
Alex Lapirro,	New Bedford,		Convicted,	20 00	
Clovis Leblanc,	New Bedford,		Convicted,	20 00	
Manuel Perry,	Berkley,	Residents hunting without certificate of registration in violation of chapter 484, Acts of 1908, as amended by chapter 325, Acts of 1909,	Convicted,	10 00	
William A. Walker,	Westport,		Convicted,	–	Filed.
Antonio Prone,	Lawrence,		Convicted,	–	Sentence suspended.
Walter H. Jones,	Worcester,		Convicted,	10 00	
Bernard E. Page,	Walpole,		Convicted,	10 00	
David P. Allen,	Framingham,		Convicted,	10 00	
Carl S. Church,	Arlington,		Convicted,	10 00	
Donald H. Church,	Arlington,		Convicted,	10 00	
George S. Taylor,	West Yarmouth,		Convicted,	10 00	
Charles A. Fulton,	Boston,		Convicted,	–	Filed.
Ellis B. West,	Revere,		Convicted,	10 00	
Guy P. Arienti,	Great Barrington,		Convicted,	3 00	
Peter Arienti,	Great Barrington,		Convicted,	5 00	
George K. Tuttle,	South Acton,		Discharged,	–	
Andrew Tucker,	Middleborough,		Convicted,	–	Filed.
William Heber,	Readville,		Convicted,	5 00	
William F. Osgood,	Reading,		Convicted,	10 00	
Charles H. King,	Mansfield,		Convicted,	10 00	
Walter Johnson,	Lynn,		Convicted,	10 00	
James McDonald,	Harvard,		Convicted,	–	Filed.
Eugene Lindsey,	Russell,		Convicted,	10 00	
Arthur Delorey,	Lynn,		Convicted,	10 00	
Harry Smith,	Peabody,		Convicted,	10 00	
Charles Dudley,	Athol,		Convicted,	10 00	
Jugas Thomaszunas,	Athol,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Eugene Battiston,	Leverett,	Residents hunting without certificate of registration in violation of chapter 484, Acts of 1908, as amended by chapter 325, Acts of 1909,	Convicted,	$10 00	
Peter Lucy,	Leverett,		Convicted,	10 00	
Alton C. Tuckerman,	Tisbury,		Convicted,	10 00	
Arthur J. Gould,	Middleton,		Convicted,	10 00	
Louis Ouilette,	Taunton,		Convicted,	–	Filed.
Daniel Hawley,	Arlington,		Convicted,	10 00	
Myron L. Newton,	Charlemont,		Convicted,	10 00	
Daniel Debieu,	Holyoke,		Convicted,	–	Filed.
Charles H. Chase,	Mansfield,		Convicted,	–	Filed; paid costs of court, $2.35.
David Palmer,	Adams,		Convicted,	10 00	
Albert Farren,	Hawley,		Discharged,	–	
Michael Murphy,	Ware,		Convicted,	10 00	
Steven C. Webster,	Scituate,		Convicted,	10 00	
Joseph Sullivan,	Milford,		Convicted,	–	Filed.
Albert Bishop,	–		–	–	Defaulted.
Alfred Butler,	North Brookfield,		Discharged,	–	Paid costs of court, $4.41.
Charles H. Goodell,	Worcester,		Discharged,	–	
Paul Martino,	Northampton,	Aliens hunting without license in violation of chapter 317, Acts of 1905, as amended by chapter 402, Acts of 1908, and further amended by chapter 614, Acts of 1910,	Convicted,	12 00	
Felix Sanfanelli,	Springfield,		Discharged,	–	
Andrici Scibelli,	Springfield,		Convicted,	10 00	
Waldo Biancout,	Springfield,		Convicted,	10 00	
Antone Sylvia,	Oak Bluffs,		Convicted,	10 00	
James Mauvisk,	Lowell,		Convicted,	10 00	
Ambrose Newell,	Douglas,		Convicted,	15 00	
Stephen Gozzleo,	North Adams,		Convicted,	10 00	
Philip Mongini,	Sheffield,		Convicted,	–	Continued subject to good conduct.
Andy McCollum,	Topsfield,		Convicted,	10 00	
Ortaniojio Ojiniajio,	Sharon,		Convicted,	10 00	
Primo Guietti,	Springfield,		Convicted,	10 00	
Michael Grilli,	Boston,		Convicted,	10 00	
Patrick Rocco,	Boston,		Convicted,	10 00	
Joseph Censato,	Richmond,		Convicted,	10 00	
Natale Amici,	Lee,		Convicted,	15 00	
Angelo Bortelli,	Lee,		Convicted,	15 00	
George Guarini,	Monroe,		Convicted,	15 00	
Bernardo Dominico,	North Attleborough,		Convicted,	10 00	Sent to jail for assault, etc.; 9 months.
Voladyslaw Wynyski,	Norwood,		Convicted,	10 00	
Joseph Antolini,	Lynn,		Convicted,	15 00	

Samuel Bonner,	Brookfield,	Aliens hunting without license in violation of chapter 317, Acts of 1905, as amended by chapter 402, Acts of 1908, and further amended by chapter 614, Acts of 1910,	Convicted,	15 00	Appealed; paid in superior court.
Fred Bonner,	Brookfield,		Convicted,	15 00	Appealed; paid in superior court.
Napoleon Desrosiers,	Athol,		Convicted,	10 00	
Pietro Dinicolo,	Fitchburg,		Convicted,	10 00	
Nicolo Castronomo,	Lynn,		Convicted,	10 00	
Ambrose Newell,	East Douglas,		Convicted,	10 00	
Umberto Songani,	Hudson,		Convicted,	10 00	
Endor Carroll,	New Bedford,		Convicted,	10 00	
Vito Margiotta,	Wakefield,	Killing song or insectivorous birds in violation of section 7, chapter 92, Revised Laws, as amended by chapter 250, Acts of 1907,	Convicted,	10 00	
George Guarini,	Monroe,		Convicted,	10 00	
Robert J. Coleman,	Lynn,		Convicted,	10 00	
John Taglioferri,	Athol,		Convicted,	10 00	
William F. Flynn,	Belchertown,		Convicted,	10 00	
Charles F. Michael,	Gloucester,		Convicted,	10 00	
John J. Ellis,	Gloucester,		Convicted,	10 00	
John Piscol,	Chicopee,		Convicted,	10 00	
Lawrence Gallagher,	New Bedford,		Convicted,	–	Filed.
Fred Varone,	East Brookfield,		Convicted,	–	Filed.
John Kier,	Palmer,	Killing or hunting deer in violation of chapter 396, Acts of 1909, and section 1, chapter 545, Acts of 1910,	Convicted,	50 00	
John Simonds,	Palmer,		Discharged,	–	
Thomas Cook,	Lee,		Convicted,	20 00	
James Wilson, Jr.,	West Stockbridge,		Convicted,	10 00	
Charles Healy,	Montgomery,		Convicted,	–	Filed.
Gilbert Adkins,	Montgomery,		Convicted,	–	Filed.
George Rounds,	Williamstown,		Discharged,	–	
Everett W. Donalson,	Sutton,		Convicted,	–	Filed; paid costs of court, $12.
Edward L. Cosgrove,	Northfield,		Convicted,	75 00	Appealed; discharged in superior court.
Walter F. Gould,	Ipswich,		Convicted,	–	Filed.
Donald Powell,	Wilbraham,		Convicted,	25 00	
Robert J. Hartness,	Grafton,		Discharged,	–	
John A. Lucas,	Sharon,		Discharged,	–	
Sydney A. Weston,	Sharon,		Discharged,	–	
William R. Snow,	Sharon,		Discharged,	–	
Benjamin A. Lucas,	Sharon,		Convicted,	50 00	Appealed.
William Parker,	Sharon,		Discharged,	–	
Robert G. Morse,	Sharon,		Discharged,	–	
Clarence E. Heath,	Dedham,		Discharged,	–	
John S. Nichols,	Hartford, Conn.,	Nonresidents hunting without license in violation of chapter 198, Acts of 1907, as amended by chapter 262, Acts of 1909,	Convicted,	15 00	
Thomas R. Brown,	Montclair, N. J.,		Convicted,	10 00	
William H. Kent,	Providence, R. I.,		Convicted,	5 00	
Emil Johnson,	Boylston,	Hunting on Lord's day in violation of chapter 176, Acts of 1904,	Convicted,	–	Probation for six months.
William P. Brigham,	West Boylston,		Convicted,	10 00	Appealed; paid in superior court.
George S. Taylor,	West Yarmouth,		Convicted,	10 00	
Morris I. Johnson,	West Yarmouth,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Stephen Gozzleo,	North Adams,	Hunting on Lord's day in violation of chapter 176, Acts of 1904,	Convicted,	–	Filed.
Harry Smith,	Lawrence,		Convicted,	$10 00	Also costs of court, $1.90.
Michael Grilli,	Boston,		Convicted,	10 00	Gun confiscated.
Patrick Rocco,	Boston,		Convicted,	10 00	
Charles Barrett,	North Andover,		Convicted,	10 00	Also costs of court, $4.38.
Joseph Censato,	Richmond,		Convicted,	10 00	
Arthur Flebotte,	Indian Orchard,		Convicted,	5 00	
Adelino Castignetti,	Framingham,		Convicted,	15 00	
William F. Flynn,	Belchertown,		Convicted,	10 00	
Joseph Brusti,	Chicopee,		Convicted,	15 00	
Daniel Santry,	South Weymouth,		Convicted,	–	Filed; costs of court, $3.
Ralph H. Proctor,	South Weymouth,		Convicted,	–	Filed; costs of court, $3.
Henry Eaton,	Berkley,		Discharged,	–	
Ralph Dembroder,	Harvard,		Discharged,	–	
James McDonald,	Harvard,		Convicted,	10 00	
Joseph Fraser,	Fall River,		Convicted,	–	Filed.
Charles F. Carlton,	Halifax,		Convicted,	10 00	
George Seidel,	Adams,		Convicted,	–	Filed.
David Palmer,	Adams,		Convicted,	–	Filed.
Edward Fencler,	Lynnfield,		Convicted,	10 00	
Konstantz Yackewicz,	Cambridge,		Convicted,	5 00	
Joseph Chevator,	Cambridge,		Convicted,	5 00	
Ardino Andrizzi,	Natick,		Convicted,	10 00	
Guiseppe Pangini,	Natick,		Convicted,	10 00	
Stanislaw Bursee,	Worcester,		Convicted,	–	Filed; costs of court, $5.
Walter H. Jones,	Worcester,	Hunting with ferret in violation of section 11, chapter 92, Revised Laws, as amended by chapter 328, Acts of 1909; also chapter 533, Acts of 1910,	Convicted,	20 00	
Frederick G. Smith,	Worcester,		Convicted,	20 00	
David Palmer,	Adams,		Convicted,	10 00	
George Seidel,	Adams,		Convicted,	10 00	
John L. Doyle,	North Oxford,		Convicted,	25 00	
James J. Rice,	North Oxford,		Convicted,	25 00	
John White,	North Oxford,		Convicted,	25 00	
Theo. Matheis,	Cohasset,	Setting snares, traps, etc., in violation of chapter 328, Acts of 1909,	Convicted,	15 00	
Philip Mongini,	Sheffield,		Convicted,	20 00	
George Simpson,	Medfield,		Convicted,	20 00	
Charles Winslow,	Fall River,	Setting seine in violation of section 4, chapter 401, Acts of 1885,	Convicted,	20 00	
Elbridge Dam,	Weymouth,	Netting smelts in violation of section 74, chapter 91, Revised Laws.	Convicted,	50 00	
Carl Wheble,	Weymouth,		Discharged,	–	

William Wall,	Braintree,	Possession of smelts in close season in violation of section 71, chapter 91, Revised Laws,	Convicted,	5 00	
William White,	Braintree,		Convicted,	5 00	
Frank McCue,	Braintree,		Convicted,	25 00	Failed to pay; went to jail.
William E. Crossman,	Weymouth,		Convicted,	5 00	
Carl Wheble,	Weymouth,		Convicted,	15 00	
Joseph Allen,	Fall River,	Taking fish which frequent fresh water in violation of section 132, chapter 91, Revised Laws, as amended by chapter 498, Acts of 1908,	Convicted,	20 00	
Charles Winslow,	Fall River,		Convicted,	30 00	Appealed; paid $20 in superior court.
William McNorton,	Fall River,		Convicted,	–	Filed; paid costs, $7.50.
Phillip H. Negus,	Fall River,		Convicted,	–	Filed; paid costs, $7.50.
Waldo Sherman,	Freetown,		Convicted,	–	Filed; paid costs, $7.50.
John Van Valkenburgh,	Sheffield,		Convicted,	5 00	
Dennis Shea,	Holyoke,		Convicted,	10 00	
Salvatore Celona,	Norton,		Convicted,	15 00	
Angelo Matoratonio,	Norton,		Convicted,	15 00	
N. E. Booth,	Fall River,	Possession of live song or insectivorous birds in violation of section 7, chapter 92, Revised Laws, as amended by section 1, chapter 250, Acts of 1907,	Convicted,	–	Filed; paid costs, $1.55.
Henry Strom,	Montague,	Possession of trout in close season in violation of chapter 377, Acts of 1909,	Convicted,	10 00	
Wyatt H. Hathaway,	Palmer,	Killing deer with rifle in violation of section 17, chapter 92, Revised Laws, as amended by chapter 396, Acts of 1909,	Convicted,	–	Filed.
Leonard Bartlett,	Walpole,	Having trout under 6 inches in possession in violation of chapter 377, Acts of 1909; also chapter 469, Acts of 1910,	Convicted,	1 00	
Walter Turner,	Hawley,		Convicted,	20 00	Also costs of court, $4.
Joseph Monto,	Pittsfield,		Convicted,	25 00	
William L. Neilson,	Worcester,		Convicted,	5 00	
Arthur Smith,	Barre,		Convicted,	5 00	
O. V. White,	Worcester,		Convicted,	5 00	
Henry Forgette,	Springfield,		Convicted,	20 00	
Henry Walker,	Worcester,		Convicted,	10 00	
Howard Gilson,	Boston,		Convicted,	20 00	
Henry Peach,	Malden,	Fishing in closed ponds in violation of section 19, chapter 91, Revised Laws, as amended by chapter 306, Acts of 1907,	Convicted,	20 00	
Alfred Turner,	Lawrence,		Convicted,	–	Filed.
Nathan B. McLoud,	Dorchester,		Convicted,	10 00	
Edwin E. Farnham,	Belmont,		Convicted,	–	Filed.
F. L. Johnson,	Waltham,		Convicted,	–	Filed.
Harry A. Wilson,	Waltham,		Convicted,	–	Filed.
William A. Graham,	Waltham,		Convicted,	5 00	
Frank Churchill,	Hanson,		Convicted,	–	Filed.
Joseph Semond,	Hanson,		Convicted,	–	Filed.
John H. Southworth,	Brockton,		Convicted,	–	Filed.
Charles B. Southworth,	Hanson,		Convicted,	–	Filed.
Edward Darrington,	Westfield,		Convicted,	5 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Albert P. Fields,	Taunton,	Dogs chasing deer in violation of section 18, chapter 92, Revised Laws, as amended by chapter 245, Acts of 1905,	Convicted,	–	
Howard Hathaway,	Dighton,		Discharged,	–	Filed; costs of court, $4.10.
John Carlson,	Rutland,		Convicted,	$10 00	Also costs of court, $9.
Thomas A. Joyce,	Lynn,		Convicted,	–	Filed; costs of court, $1.30.
James O'Brien,	Westford,		Convicted,	5 00	
John A. Lucas,	Sharon,		Convicted,	10 00	Appealed.
William Parker,	Sharon,		Convicted,	10 00	Appealed.
Elizabeth Poirier,	New Bedford,	Possession of prohibited birds, etc., for millinery in violation of chapters 244 and 329, Acts of 1903,	Convicted,	10 00	
Annie F. Riley,	New Bedford,		Convicted,	10 00	
Walter H. Brown,	Fall River,		Convicted,	10 00	
Katherine A. Burns,	Fall River,		Convicted,	10 00	
Louise Tilman,	Fall River,		Convicted,	10 00	
George L. Bump,	Fall River,		Convicted,	10 00	
Fred E. Bagley,	New Bedford,		Convicted,	10 00	
Arthur Boisclair,	New Bedford,		Convicted,	10 00	
Fred C. Munch,	Hull,	Having in possession lobsters under the legal length in violation of chapter 303, Acts of 1907,	Convicted,	55 00	
Cortas Theodore,	New Bedford,		Convicted,	15 00	
Louis Corayer,	Hull,		Convicted,	10 00	
Charles Davis,	Plymouth,		Convicted,	17 00	
Nelson S. Bartlett,	Barnstable,		Convicted,	5 00	
Manuel Salvatore,	Cohasset,		Convicted,	16 00	
William V. Corinha,	Winthrop,		Discharged,	–	
Fred Fredericks,	Nahant,		Convicted,	3 00	
Charles Roberts,	Nahant,		Convicted,	20 00	
Antoni Fanarlari,	Nahant,		Convicted,	10 00	
Foster G. Sherman,	Fall River,	Intent to sell egg-bearing lobsters in violation of section 86, chapter 91, Revised Laws,	Convicted,	20 00	
Oscar F. Gibbs,	Dennis,		Convicted,	10 00	
Maurice A. Hayden,	Bridgewater,		Convicted,	10 00	
Ignatius Bullock,	Templeton,	Possession of wild duck in close season in violation of chapter 421, Acts of 1909,	Convicted,	–	Filed; costs of court, $2.45.
Tony Ferriara,	Hull,	Interfering with and assault on deputy,	Discharged,	–	
Frederick C. Davis,	Bourne,	Potting eels without permit in violation of section 85, chapter 91, Revised Laws,	Convicted,	5 00	
Andrew F. Stolberg,	Worcester,	Having in possession pickerel under 10 inches in length in violation of section 67, chapter 91, Revised Laws, as amended by chapter 329, Acts of 1904,	Convicted,	6 00	
Charles Tobin,	Holyoke,		Convicted,	1 00	

George Smith,	Fall River,	Having in possession short bass in violation of section 70, chapter 91, Revised Laws,	Convicted,	10 00	
Arthur B. Lloyd,	Forest Hills,		Convicted,	10 00	
Riley Barber,	Westfield,		Convicted,	10 00	
Arthur Roy,	New Bedford,	Setting and drawing gill net in Buzzards Bay in violation of section 122, chapter 91, Revised Laws,	Convicted,	20 00	
Joseph LeBlanc,	Springfield,	Snaring trout in violation of section 1, chapter 377, Acts of 1909,	Convicted,	20 00	
Albert Donovan,	Boston,	Killing gray squirrels in violation of chapter 564, Acts of 1910,	Convicted,	10 00	
Leigard Robsham,	Framingham,		Convicted,	–	Filed.
Henry Parlee,	Chelmsford,		Convicted,	–	Filed.
James McDonald,	Harvard,		Convicted,	–	Filed.
Robert J. Hartness,	Grafton,		Convicted,	10 00	
E. Chauncey Gilmore,	Hopedale,		Convicted,	10 00	
Guiseppe Pangini,	Natick,		Convicted,	10 00	
Edwin Smith,	Boxborough,		Convicted,	–	Filed.
Arthur A. Pritchard,	Worcester,		Discharged,	–	
Frank O. Howard,	Worcester,		Discharged,	–	
Salvatore Aloudi,	Boston,	Torching herring in violation of chapter 291, Acts of 1909,	Convicted,	–	Filed.
Tony Ramponi,	Boston,		Convicted,	–	Filed.
Joseph Samarto,	Boston,		Convicted,	100 00	
Joseph Marino,	Boston,		Convicted,	–	Filed.
Kolor Metera,	Boston,		Convicted,	50 00	
Frank Spinola,	Boston,		Convicted,	50 00	
Jio Bello,	Boston,		Convicted,	50 00	
Tony Busalack,	Boston,		Convicted,	50 00	
Carlo Moricer,	Boston,		Convicted,	50 00	
Vincenzo Senagro,	Boston,		Convicted,	50 00	
Maszzo Shiulla,	Boston,		Discharged,	–	
Antonio Shiulla,	Boston,		Convicted,	50 00	Sentence suspended.
Antonio Briano,	Boston,		Convicted,	50 00	Sentence suspended.
Vincenzo Fishia,	Boston,		Convicted,	50 00	
Vincenzo Lomea,	Boston,		Convicted,	50 00	Sentence suspended.
William Savory,	Chelsea,	Selling clams from polluted areas in violation of chapter 285, Acts of 1907,	Convicted,	15 00	
Christopher Neilson,	Hull,		Discharged,	–	
William G. Walsh,	Boston,		Discharged,	–	
Michael H. McDonough,	Lee,	Killing fish by pollution in violation of section 133, chapter 91, Revised Laws, as amended by chapter 246, Acts of 1903,	Convicted,	10 00	
Fred A. Kehoe,	Rutland,	Shooting a bittern or heron in violation of chapter 244, Acts of 1903,	Convicted,	–	Filed.
Lincoln Greeley,	Rockland,		Convicted,	–	Filed.
George A. Wolfe,	Dorchester,		Convicted,	6 00	Also costs of court, $2.90.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Frank A. Sampson,	New Salem,	Failure to notify Commissioner on Fisheries and Game of deer shot while damaging crops in violation of chapter 545, Acts of 1910,	Convicted,	$20 00	
Bernardo Dominico,	North Attleborough,	Assault with dangerous weapon,	Convicted,	–	Nine months in jail; costs, $2.50.
Elmer Larson,	Milford,	Killing pheasants in violation of chapter 309, Acts of 1909,	Convicted,	10 00	
Ernesto Rarmelli,	Lynn,		Convicted,	25 00	
Cherubino Roberts,	Lynn,		Convicted,	25 00	
James L. Kelso,	Winthrop,		Convicted,	5 00	
William Francis,	Concord,		Convicted,	10 00	
Leon E. Mayo,	Medfield,		Convicted,	10 00	
Christopher Stone,	Ashland,	Snaring ruffed grouse in violation of chapter 533, Acts of 1910,	Convicted,	5 00	
Christopher Stone,	Ashland,	Possession of ruffed grouse in close season in violation of chapter 365, Acts of 1910,	Convicted,	20 00	
George H. Holmes,	Boston,		Convicted,	–	Continued to December 17, for sentence.
William M. Taylor,	Lynn,	Killing tern in violation of chapter 472, Acts of 1910,	Convicted,	20 00	
Lewis G. Doten,	Plymouth,	Using sweep seine in violation of section 52, chapter 91, Revised Laws,	Discharged,	–	
Joseph Bugsbee,	– – –	Selling game birds in violation of chapter 441, Acts of 1908, as amended by chapter 272, Acts of 1909,	Discharged,	–	
Wendal Eldridge,	Harwich,	Possession of illegal scallops in violation of section 1, chapter 177, Acts of 1910,	Convicted,	–	Filed.
E. Chauncey Gilmore,	Hopedale,	Hunting on posted land in violation of section 14, chapter 92, Revised Laws,	Convicted,	5 00	
George L. Sprague,	Milford,		Convicted,	5 00	
John Jacobson,	East Douglas,	Using over ten hooks for fishing in violation of section 26, chapter 91, Revised Laws, as amended by chapter 308, Acts of 1904,	Convicted,	20 00	
Arthur A. Pritchard,	Worcester,	Setting forest fires in violation of chapter 299, Acts of 1907,	Discharged,	–	Costs of court, $6.35.
Frank O. Howard,	Worcester,		Discharged,	–	

[G.]

Returns from the Shore Pound and Net Fisheries for the Year 1910.

Apparatus employed.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Pounds.	Value.	Nets.	Value.
Frank C. Hodgkins,	Annisquam,	12	7	$3,058 00	–	–	5	$900 00
Preston J. Marchant,								
Ensign C. Jerauld,	Barnstable,	9	4	1,100 00	2	$2,500 00	–	–
Harry C. Howell,	Beverly,	1	2	135 00	–	–	1	3 00
C. F. Wentworth,								
J. Eldridge & Son,	Brewster,	5	4	50 00	7	2,200 00	–	–
Gilbert E. Ellis,								
A. S. Hall,								
Fred W. Baker,	Chatham,	13	10	1,605 00	5	4,200 00	129	1,321 00
George N. Bearse,								
J. D. Bloomer,								
Walter C. Bloomer,								
William A. Bloomer,								
Geo. W. Crowell & Co.,								
Samuel Dill,								
Roscoe H. Gould,								
Seymour Patterson,								
E. C. Flanders & Co.,								
James Look,	Chilmark,	20	19	1,435 00	12	7,800 00	1	10 00
George W. Manter,								
Daniel W. West,								
Joseph Boutin,	Chiltonville,	3	3	280 00	1	1,000 00	7	40 00
George A. Finney, agent,								
John F. Cornell,	Cuttyhunk,	6	9	1,681 00	1	1,000 00	57	500 00
Irwin C. Hall,								
Russell W. Rotch,								
Frank B. Veeder,								

Apparatus employed — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Pounds.	Value.	Nets.	Value.
Zenas H. Baker, Benjamin Walker,	Dennis,	4	4	$1,008 00	3	$2,100 00	-	-
Charles Gardner, E. D. Perry, Albertis F. Simmons,	Dighton,	19	12	520 00	1	50 00	8	$570 00
Harry E. Hunt,	Duxbury,	4	5	2,050 00	2	3,500 00	21	700 00
E. R. Dunham, David B. Pease & Allen Mayhew,	Edgartown,	4	5	80 00	2	450 00	-	-
William A. Read,	Fall River,	1	-	-	-	-	-	-
D. D. Diamond & Co., Linus S. Jeffers & Co., A. H. Vanderhoop & Co., L. L. Vanderhoop & Co.,	Gay Head,	20	21	1,655 00	16	6,500 00	1	25 00
Fuller A. Andrews, George W. Douglas, Thomas Douglas, Joseph Douglas, Henry W. Nelson, Alexander Sargent, F. A. & C. W. Tarr,	Gloucester,	19	17	4,660 00	3	2,750 00	13	1,750 00
Orin Crosby, Clinton A. Sturges, Ansel Taylor,	Hyannis,	9	5	1,950 00	-	-	91	850 00
Alfred W. Riley,	Lanesville,	-	-	-	-	-	4	26 50
Edw. W. Heath,	Manchester,	3	6	461 00	1	1,000 00	-	-
H. D. Powell (F. H. Johnson and others), Avard L. Smith (R. A. Atwood and others),	Nahant,	12	7	1,400 00	4	6,000 00	-	-
Arthur J. Barrett & Co., Nelson Clark, Edward I. Fisher, George H. Hamblin, Arthur McCleare, John S. Watkins, George M. Winslow,	Nantucket,	22	24	7,115 00	8	3,100 00	207	3,209 00
Joseph A. Nickerson, Victorino Perry,	New Bedford,	2	2	825 00	-	-	-	-
C. A. Caswell & Co., George G. Short,	Newburyport,	10	10	3,870 00	-	-	93	1,875 00
Otis E. Burt,	North Tisbury,	1	4	185 00	2	500 00	-	-

Fred C. Rich,	North Truro,	12	10	3,680 00	–	10,000 00	–	2,000 00
Allen R. Norton,	Oak Bluffs,	–	–	–	–	–	–	–
Maurice S. Hayden,	Orleans,	–	–	–	–	–	–	–
H. E. Knowlton,								
A. L. Daggett,								
James W. Fuller,								
John Johnson,								
James E. Kelley,								
Thomas J. Lewis,								
William B. Lewis,								
A. P. Lewis & Manuel James,								
Alfred A. Mayo,	Provincetown,	44	48	16,414 00	6	5,000 00	613	5,885 00
H. L. Mayo,								
Martin Nelson,								
Frank I. Sears,								
Edwin W. Smith,								
John R. Swartz,								
Manuel P. Vera,								
J. R. Williams,								
Edwin Williams,	Raynham,	21	4	200 00	–	–	–	300 00
Antone Vieiro,	Robinson Hole,	–	–	–	–	–	–	–
Charles P. R. Fellows,	Salem,	1	1	7 00	–	–	–	–
John Elvander,	Sandwich,	2	4	565 00	1	1,100 00	4	40 00
Eugene W. Haines,								
A. N. Goff,	Segregansett,	21	5	175 00	–	–	4	400 00
J. H. Miller,	Somerset,	10	2	100 00	–	–	1	150 00
Obed S. Daggett,								
George H. Luce,								
H. Nelson Luce,	Tisbury,	14	20	1,730 00	17	5,200 00	1	40 00
J. A. Mayhew & Co.,								
W. L. & G. F. Tilton,								
John R. Walker,								
Otis B. Luce,	Vineyard Haven,	2	7	1,425 00	6	2,800 00	–	–
James R. Tilton,								
F. D. Grinnell,	Westport,	2	1	20 00	–	–	1	30 00
John J. Veeder (Marine Biological Laboratory),	Woods Hole,	3	5	5,085 00	1	600 00	–	–
Shirley D. Lovell,	Yarmouth,	2	2	20 00	1	250 00	21	195 00
Hiram E. Baker,								

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Scup.	Sea Bass.
Allerton,	–	–	–	–	–	–	–	–
Annisquam,	–	–	–	–	9,200	585,105	–	–
Barnstable,	–	–	–	23,200	–	21,500	–	–
Bay View,	–	–	–	–	–	–	–	–
Beachmont,	–	–	–	–	–	–	–	–
Beverly,	–	–	401	–	–	–	–	–
Boston,	–	–	–	–	–	–	–	–
Bournedale,	–	–	–	–	–	–	–	–
Brant Rock,	–	–	–	–	–	–	–	–
Brewster,	23,108	237	9,346	150	–	–	–	–
Chatham,	5,300	1,587	59,250	8,624	7,700	–	32,740	–
Chilmark,	100	65	32,930	9,948	–	125	5,625	3,340
Chiltonville,	–	–	–	575	–	1,000	–	–
Cohasset,	–	–	–	–	–	–	–	–
Cuttyhunk,	–	–	70,400	8,339	–	9,000	80,000	–
Dennis,	8,250	–	16,335	51	27,200	–	6,000	–
Dighton,	268,550	–	–	–	–	–	–	–
Duxbury,	–	–	–	3,200	–	36,000	–	–
Eastham,	–	–	–	–	–	–	–	–
East Mattapoisett,	–	–	–	–	–	–	–	–
Edgartown,	100	5	1,200	1,150	–	–	2,550	–
Fall River,	8,700	–	–	–	–	–	–	–
Gay Head,	52,725	–	9,600	5,050	–	100	16,900	1,175
Gloucester,	20,975	5	1,530	10,273	7,800	199,017	4	–
Green Harbor,	–	–	–	–	–	–	–	–
Hull,	–	–	–	–	–	–	–	–
Hyannis,	4,000	4,505	129,400	2,796	1,200	400	–	–
Kingston,	–	–	–	–	–	–	–	–
Lanesville,	–	–	–	–	–	–	–	–
Magnolia,	–	–	–	–	–	–	–	–
Manchester,	5,101	–	–	1,479	300	33,120	4,181	–
Manomet,	–	–	–	–	–	–	–	–
Marblehead,	–	–	–	–	–	–	–	–
Minot,	–	–	–	–	–	–	–	–
Nahant,	–	182	–	1,750	–	1,740	–	–

in Nets, Pounds, Traps, etc.

Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Total.	Value.
–	–	–	–	–	–	–	488	488	$90 00
22,200	13,800	–	–	–	–	89,774	–	720,079	6,051 91
–	–	–	–	5,000	1,200	26,000	1,390	78,290	4,826 95
–	–	–	–	–	–	–	620	620	82 60
–	–	–	–	–	–	–	6,462	6,462	1,179 00
–	–	–	–	–	–	1,200	29,427	31,028	3,759 95
–	–	–	–	–	–	–	8,741	8,741	1,000 42
–	–	–	–	–	–	–	19,946	19,946	1,870 78
–	–	–	–	–	–	–	14,459	14,459	1,799 76
66,500	–	17	54	16,925	2,293	25,457	–	144,087	2,596 00
40,681	304	10,556	100	76,965	1,955	52,398	22,844	321,004	13,476 55
–	–	23,221	–	2,350	20	180	29,733	107,637	7,403 26
700	–	–	–	–	375	1,800	31,063	35,513	3,144 74
–	–	–	–	–	–	–	92,871	92,871	12,831 24
–	–	1,800	–	–	–	–	131,997	301,536	18,630 81
13,325	32	900	–	141,800	7,285	26,125	4,172	251,475	5,275 62
–	3,637	–	–	–	–	5,175	–	277,362	2,925 46
216,200	–	–	–	–	–	141,600	19,676	416,676	8,181 85
–	–	–	–	–	–	–	756	756	279 21
–	–	–	–	–	–	–	3,137	3,137	351 33
–	20	374	–	6,500	–	4,950	98	16,947	513 46
–	4	–	–	–	55	2	–	8,761	90 40
–	75	5,620	–	2,200	1,775	1,505	17,784	114,509	4,316 34
63,482	468	–	–	6,810	134	554,122	68,799	933,419	15,420 57
–	–	–	–	–	–	–	129,170	129,170	13,442 54
–	–	–	–	–	–	–	31,394	31,394	4,350 75
–	–	450	32	–	–	–	2,036	144,819	3,007 20
–	–	–	–	–	–	–	6,629	6,629	864 93
1,340	–	–	–	–	–	–	12,654	13,994	3,436 59
–	–	–	–	–	–	–	1,802	1,802	185 35
19,000	285	–	–	1,800	626	308,876	8,057	382,825	3,027 06
–	–	–	–	–	–	–	139,067	139,067	12,754 09
–	–	–	–	–	–	–	136,680	136,680	17,875 56
–	–	–	–	–	–	–	12,270	12,270	1,066 70
277,180	–	–	–	9,700	–	387,648	25,031	703,231	8,078 96

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Scup.	Sea Bass.
Nantasket,	–	–	–	–	–	–	–	–
Nantucket,	200	18,291	3,410	66,882	–	1,580	10,550	–
New Bedford,	–	–	12,357	–	–	–	1,300	–
Newburyport,	–	–	–	400	–	410,927	–	–
North Tisbury,	6,000	–	1,450	–	–	3,000	1,400	100
North Truro,	–	–	15,921	10,424	19,200	4,500	–	–
Oak Bluffs,	–	–	–	–	–	–	–	–
Onset,	–	–	–	–	–	–	–	–
Orleans,	–	–	120	–	–	20	–	–
Pembroke,	–	–	–	–	–	–	–	–
Plymouth,	–	–	–	–	–	–	–	–
Provincetown,	–	–	897,710	157,839	–	23,400	–	–
Quincy,	–	–	–	–	–	–	–	–
Raynham,	368,800	–	–	–	–	–	–	–
Robinson Hole,	–	–	–	–	–	–	2,000	–
Rockport,	–	–	–	–	–	–	–	–
Sagamore,	–	–	–	–	–	–	–	–
Salem,	–	–	7,700	–	–	–	–	–
Sandwich,	–	–	1,000	2,658	387	38	–	–
Scituate,	–	–	–	–	–	–	–	–
Segregansett,	455,000	–	–	–	–	–	–	–
Somerset,	170,000	–	–	–	–	–	–	–
Swampscott,	–	–	–	–	–	–	–	–
Tisbury,	800	462	22,050	4,230	–	1,450	11,800	528
Vineyard Haven,	16,000	6	2,158	152	–	550	12,546	414
West Falmouth,	–	–	–	–	–	–	–	–
Westport,	1,500	–	–	–	–	–	100	–
West Tisbury,	–	–	–	–	–	–	–	–
Weymouth,	–	–	–	–	–	–	–	–
Whitman,	–	–	–	–	–	–	–	–
Winthrop,	–	–	–	–	–	–	–	–
Woods Hole,	–	45	–	896	204,100	–	28,120	–
Yarmouth,	37,600	–	600	–	–	–	–	–
Totals,	1,452,809	25,390	1,294,868	320,066	277,087	1,332,572	215,816	5,557

in Nets, Pounds, Traps, etc. — Concluded.

Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Total.	Value.
–	–	–	–	–	–	–	33,870	33,870	$4,465 05
14,600	70	9,077	–	–	–	53,051	6,333	184,044	13,513 93
–	–	–	–	–	400	–	18,546	32,603	2,558 57
71,156	68,200	–	–	–	–	188,660	–	739,343	7,289 10
–	–	3,000	–	2,500	–	–	1,313	18,763	787 00
241,300	50	890	–	540,200	405	764,117	–	1,597,007	15,660 31
–	–	–	–	–	–	200	–	200	25 00
–	–	–	–	–	–	–	7,272	7,272	594 00
–	–	–	–	–	–	100	2,030	2,270	469 74
–	–	–	–	–	–	–	1,287	1,287	102 96
–	–	–	–	–	–	–	86,819	86,819	10,251 30
342,475	2,400	–	–	570,430	–	333,600	2,972	2,330,826	51,598 32
–	–	–	–	–	–	–	131	131	28 95
–	2,132	–	–	–	–	–	–	370,932	1,449 60
–	–	–	–	–	1,100	–	5,916	9,016	904 00
–	–	–	–	–	–	–	55,550	55,550	5,799 91
–	–	–	–	–	–	–	2,522	2,522	256 55
–	–	–	–	–	–	–	48,785	56,485	7,206 38
2,200	240	–	–	39,400	–	43,421	6,733	96,077	2,324 51
–	–	–	–	–	–	–	26,930	26,930	2,309 67
–	3,850	–	–	–	–	100	–	458,950	2,445 00
–	125	–	–	–	–	–	–	170,125	1,409 00
–	–	–	–	–	–	–	9,989	9,989	1,271 57
–	10	105,343	118	9,950	2,475	1,350	–	160,566	5,257 14
–	5	12,677	–	15,800	–	4,455	3,717	68,480	2,386 96
–	–	–	–	–	–	–	1,401	1,401	413 60
–	–	–	–	–	3,900	6,600	24,479	36,579	3,750 42
–	–	–	–	–	–	–	29,592	29,592	3,101 21
–	–	–	–	–	–	–	20,004	20,004	3,169 26
–	–	–	–	–	–	–	1,482	1,482	186 97
–	–	–	–	–	–	–	9,336	9,336	1,623 80
1,950	–	10,430	–	23,445	370	20,275	22,293	311,924	4,238 60
–	–	–	–	–	–	22,345	1,511	62,056	1,430 00
1,394,289	95,707	184,355	304	1,471,775	24,368	3,065,086	1,440,066	12,600,115	$342,466 32

Returns from the Lobster Fisheries.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
M. W. Springer,	Allerton,	1	1	$25 00	18	$20 00	325	$90 00	-
Clarence Chase,	Barnstable,	2	2	250 00	40	50 00	893	126 95	-
Daniel S. Burnham,	Bay View,	1	1	15 00	50	50 00	413	82 60	-
Charles Neil,	Beachmont,	1	1	400 00	150	450 00	4,308	1,179 00	41
John Anderson,									
C. W. Foster and Warren Hersey,									
Albion Frye,									
Harry C. Howell,	Beverly,	12	16	2,580 00	906	1,506 00	19,618	3,663 18	105
Wallace C. Kenney,									
Nelson A. Southwick,									
C. F. Wentworth,									
Joaquin Perry,									
Joseph Serrilla,	Boston,	3	8	995 00	330	330 00	5,827	1,000 42	-
Manuel Serrilla,									
A. J. Chandler,									
Frank C. Leonard,	Bournedale,	4	6	515 00	204	250 00	13,297	1,870 78	107
Percy H. Marsh,									
Albert A. Nightingale,									
C. C. Cady,									
J. Thomas Doten,									
Fred L. Ford,									
Clifford G. Harris,	Brant Rock,	8	8	330 00	347	489 00	9,639	1,799 76	-
M. H. Hewins,									
Wm. A. Pool,									
J. E. White,									
B. R. Baker,									
Fred W. Baker,									
Anson C. Bloomer,									
Bradford N. Bloomer,									
Jos. D. Bloomer,									
Walter C. Bloomer,									
Wm. A. Bloomer,									
Samuel Dill,									
Walter N. Eldredge,	Chatham,	19	33	5,635 00	1,096	1,468 00	15,229	5,570 40	1,452

Walter W. Eldredge,									
Chas. G. Hamilton,									
T. W. Holway,									
Edson F. Olson,									
Seymour Patterson,									
B. F. Rich,									
Chas. E. Smith,									
N. W. Hamilton,									
E. J. Dean,									
Roy E. Cottle,									
Jerry Look,									
Benj. C. Mayhew,									
Wm. S. Mayhew,	Chilmark,	12	18	3,890 00	611	1,112 00	19,822	2,722 75	146
Everett A. Poole,									
Austin E. Smith,									
J. D. and F. P. Tilton,									
Onslow Stuart,									
Joseph Boutin,									
John E. Finney,									
Ernest Johns,									
Albert F. Pierce,									
Chas. H. Pierce,	Chiltonville,	12	18	1,150 00	462	652 00	20,675	2,834 74	82
H. S. Sampson,									
R. F. Swift,									
Levi S. Thurston,									
Geo. T. Ainslie,									
Joseph Bandura,									
Levi Cadose,									
John Eltman,									
Antoine S. Figueiredo,									
Anton Grassie,									
Patrick Grassie,									
Manuel Oliver,	Cohasset,	15	25	4,787 00	1,925	3,005 00	61,914	12,831 24	160
Andrew Peterson,									
Orne Peterson,									
Antone Sidney,									
Antoine L. Silvia,									
Joseph A. Silvia,									
Manuel L. Trombas,									
Frank Veira,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
D. N. Bosworth,									
Joseph Comara,									
John Cornell,									
Harold F. Deane,									
Thomas B. Dowling,									
Isaac Gregory,									
Irwin C. Hall,									
Sam'l E. Jackson & Co.,									
Geo. C. King,									
Walter Loveridge,	Cuttyhunk,	25	36	$10,859 00	1,935	$2,147 50	87,998	$13,310 38	907
Frank Peters,									
Louis J. Ramos,									
Russell W. Rotch,									
Roland S. Snow,									
Oscar H. Stetson,									
Chester F. and Frank B. Veeder,									
Ernest G. Veeder,									
Harold S. Veeder,									
Oscar F. Gibbs,									
Austin F. Howes,									
A. P. Howes,	Dennis,	4	8	406 00	190	100 00	2,781	573 19	92
Benj. Walker,									
Sam'l P. Burgess,									
Chester N. Morse,									
Wm. K. Bartlett,	Duxbury,	8	12	700 00	325	520 00	13,117	2,269 85	140
Frank E. Wadsworth,									
Sam'l G. I. Wadsworth,									
Henry E. Knowles,	Eastham,	2	2	310 00	50	138 00	504	279 21	32
Joshua L. Macomber,	East Mattapoisett,	2	4	580 00	100	64 00	2,091	351 33	-
N. P. Nye,									
Manuel Deloura,	Edgartown,	1	2	615 00	6	6 00	65	13 00	-
Benj. J. Attaquin,									
Granville M. Belain,									
M. P. Cooper,									
J. A. Mayhew & Co.,	Gay Head,	8	19	1,592 00	360	365 00	11,856	1,508 96	171
Harry G. Reed,									
Chas. H. Ryan,									

Edward L. Ashley, Henry H. Ashley, Frank B. Brewer, C. A. Dixon, Nelson F. King, Peter Knutson, Walter E. Marchant, D. E. Mehlman, Joseph S. Moniz, Albert and Howard Parsons, Edwin F. Parsons, Elbridge D. Rust, Everett L. Small, Arthur Stevens, Joseph Douglass, Melvin Parsons,	Gloucester,	17	22	1,698 00	1,067	1,307 00	45,866	8,099 86	156
Robert Brown, Wm. M. Cushing, George Delano, W. M. Englestead, Geo. W. Gardner, Wilfred Keene, C. E. Peterson, Chas. R. Peterson, Lyman Sears, A. I. Shaw, Herbert P. Tolman, Wm. H. Tolman,	Green Harbor,	13	34	11,777 00	1,406	2,573 25	86,113	13,442 54	469
Walter F. Kelley, Ambrose B. Mitchell, F. C. Munch,	Hull,	4	8	807 00	415	550 00	20,896	4,350 75	30
Orin Crosby, Clinton A. Sturges,	Hyannis,	–	–	–	82	32 00	1,357	278 00	55
Allen R. Gorham, H. S. West,	Kingston,	2	2	750 00	95	136 25	4,419	864 93	22
Chas. W. Lucas, Edward M. Poland, Alfred W. Riley, Addison H. Woodbury, Geo. H. Woodbury,	Lanesville,	7	7	95 00	235	255 00	9,436	3,398 83	40
John B. Knowlton,	Magnolia,	1	2	14 00	34	50 00	1,201	185 35	12
Augustus Ferreiro, David C. Jones,	Manchester,	3	1	400 00	135	165 00	5,371	820 87	15

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
H. S. Arnold,									
C. D. Bacon,									
A. R. Barney,									
E. H. Bartlett,									
Sam'l H. Benson,									
G. L. Binney,									
Laban B. Briggs, Jr.,									
James E. Burke,									
H. D. Cleveland,									
Geo. D. Cook,									
Chas. A. Dixon,									
Comfort H. Dixon,	Manomet,	28	42	$3,648 00	1,605	$2,602 00	92,711	$12,754 09	226
Archie Fenton,									
Geo. W. Holmes,									
Ralph B. Holmes,									
Geo. A. Manter,									
W. J. Nightingale,									
Frank R. Peterson,									
Jack Platt,									
Chas. W. Raymond,									
J. E. Raymond,									
Robert Richardson,									
Rodmond D. Rogers,									
Laban B. Briggs,									
Clinton Adams,									
Wm. F. Allen,									
Harvey L. Bailey,									
Chas. O. Briggs,									
J. E. Brown,									
Ernest Cronk,									
W. F. Dennis,									
Peter J. Farry,									
Arthur D. Frost,									
Fred A. Fuller,									
Wm. F. Gardner,									

Thos. P. Gilbert,									
Everett S. Hamson,									
Geo. K. Hamson, Jr.,									
David P. Howe,									
John G. Howe,									
Patrick H. Keenan,									
Thos. P. Lyons,	Marblehead,	38	50	7,408 00	1,698	2,315 00	91,120	17,875 56	492
John W. Mace,									
James H. Magee,									
Jonathan B. Mason,									
Wm. F. Merritt,									
Harry A. Oliver,									
Everett P. Peach,									
Joseph S. Phillips,									
Augustus K. Roundy,									
Stephen Q. Smith,									
Wm. T. Smith,									
Chas. H. Smithurst,									
Clarence K. Stone,									
Samuel Stone,									
John F. Trefry,									
Wm. H. Tutt,									
J. S. Withum,									
C. H. Pratt,									
Eugene Pratt,									
Danforth P. Sylvester,	Minot,	5	7	360 00	275	275 00	8,180	1,066 70	38
Chas. DeCoste,									
E. H. Crowell,									
Gilbert G. Hunt,									
G. H. Lamphier,									
Herbert E. Potter,	Nahant,	7	11	1,035 00	370	407 50	16,687	3,112 00	112
Wm. A. Smith,									
Chas. W. Taylor,									
Joseph B. Tibbets,									
Harry C. Bates,									
R. F. Gardner,									
Frank Lean,									
Sam'l McDonald,	Nantasket,	7	6	720 00	444	570 00	22,580	4,465 05	149
Ephraim Onderkirk,									
Geo. L. Hatch,									
Henry E. Hatch,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Walter Jewett, Joseph Mayo, Arthur McCleare, Joseph H. Ray, Adolph A. Rohdin, Manuel Thomas, John S. Watkins,	Nantucket,	8	8	$385 00	276	$286 75	4,222	$1,328 99	113
Geo. M. McLain, J. A. Nickerson, Victorino Perry, Bartholomew Sylvia, Geo. B. Taber, Manuel Cambra,	New Bedford,	9	7	1,783 00	370	465 00	12,364	2,003 49	200
Otis E. Burt,	North Tisbury,	-	-	-	30	50 00	875	150 00	25
J. Alton Harrison, Wm. Thompson,	Onset,	2	5	1,355 00	130	145 00	4,848	594 00	32
Frank Freeman, Caleb Hayden, Maurice S. Hayden,	Orleans,	3	3	185 00	72	157 00	1,353	459 44	100
Edmund E. Crossley,	Pembroke,	1	2	210 00	50	50 00	858	102 96	-
George Atwell, Jas. H. Bagnall, Chas. A. Briggs, H. J. Caswell, Chas. H. Davis, John R. Harlow, Benj. F. Hodges, Whitman Nickerson, Wm. L. Peterson, Preston Ray, A. P. Sylvester, Joseph P. Thurston,	Plymouth,	12	22	4,322 00	748	1,219 35	57,879	10,251 30	147
Cushing H. Emery, Martin Nelson, Joseph S. Perry, John W. Savage, W. C. Snow, Chas. Williams, Jr.,	Provincetown,	5	5	64 00	241	203 50	1,981	727 16	78

John I. Bennett,	Quincy,	1	1	300 00	16	20 00	87	28 95	-
Manuel Marshall,	Robinson Hole,	3	4	938 00	175	150 00	3,944	766 00	9
Antone Vieiro,									
Wm. Garrow,									
Chester W. Gott,									
Chas. F. Green,									
W. I. Jones,									
Arthur Rich,	Rockport,	9	11	1,525 00	695	985 00	37,033	5,799 91	223
Wm. E. Norwood,									
Geo. E. Wendell,									
Arthur Norwood,									
S. Thurston,									
Arthur Gibbs,	Sagamore,	1	3	50 00	80	75 00	1,681	256 55	26
Geo. F. Ball,									
Chas. H. Berry,									
Chas. S. Brown,									
John A. Dunn,									
Chas. P. R. Fellows,	Salem,	10	12	1,589 00	785	1,007 25	32,523	7,047 88	182
Thos. F. Hogan,									
Louis N. Letourneau,									
Chas. L. Wales,									
Geo. H. Whelpley,									
Geo. W. Dunn,									
John Elvander,									
John F. Mahoney,	Sandwich,	2	3	250 00	82	115 00	4,485	807 76	99
E. W. Haines,									
Oscar Anderson,									
Thomas Dwyer,									
Geo. F. Edson,	Scituate,	5	9	740 00	346	525 00	17,953	2,309 67	7
Thos. S. Turner,									
Daniel Ward,									
Walter M. Boyden,	Swampscott,	2	2	500 00	150	225 00	6,659	1,271 57	-
A. B. Lewis,									
Edward W. Cleveland,									
L. E. Smith,	Vineyard Haven,	5	7	677 00	178	215 00	2,478	430 27	73
Jas. R. Tilton,									
Geo. E. Whitney,									
Geo. A. Gifford,									
Wm. A. Hammond,									
Geo. W. Hart,									
Wm. S. Head,	Westport Point,	10	11	2,420 00	460	542 50	16,319	2,811 42	226
Fred W. Palmer,									
H. G. Sowle,									
Wm. B. Whalon,									

Returns from the Lobster Fisheries — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg-bearing Lobsters.
Alvin F. Bourne, F. J. Densmore, A. L. Adams,	West Falmouth,	2	3	$215 00	38	$76 00	934	$413 60	-
Lester D. Mayhew, F. H. Reed & Co., Lewis A. Rogers, David T. Butler, Lindley W. Mayhew,	West Tisbury,	8	14	2,090 00	509	687 50	19,728	3,101 21	126
Francis J. Cain, Edwin J. Culley,	Weymouth,	2	2	450 00	250	340 00	13,336	3,169 26	45
N. G. Hatch, Geo. M. Wadsworth,	Whitman,	2	4	300 00	61	90 00	988	186 97	1
Hartley L. Wells, D. H. Fullerton, W. C. Baker,	Winthrop,	2	4	415 00	55	55 00	6,224	1,623 80	-
James F. Cook, Robert A. Gaffin, Chas. R. Grinnell, Oscar R. Hilton, Patrick J. Larkin, Alfred Nickerson, W. E. Nickerson, Frank I. Peterson, Jas. K. P. Purdum, Prince M. Stuart, A. H. Vedeler, Robt. N. Veeder, Audbrey D. Wilde,	Woods Hole,	14	18	1,978 00	336	411 00	14,862	1,950 55	216
Shirley D. Lovell,	Yarmouth,	2	4	1,040 00	75	100 00	1,007	300 00	34
		392	576	$88,127 00	23,174	$32,156 35	960,930	$170,684 98	7,213

ILLUSTRATIONS

Fig. 1. — Mature egg ready for union with male cell. Magnified 385 diameters.

Fig. 2. — Spermatozoa (male cells). Note length of tail and shape of head. No attempts were made to study the minute anatomy. Magnified 385 diameters.

Fig. 3. — Egg, twenty-five minutes after fecundation, showing the two polar cells (pc) and the faintly developed yolk lobe. Magnified 385 diameters.

Fig. 4. — Egg just previous to the first cleavage, showing large yolk lobe. Magnified 385 diameters.

Fig. 5. — The two-celled stage at the completion of the first cleavage, fifty minutes after fecundation. The larger cell contains the yolk lobe. Magnified 385 diameters.

Figs. 6, 7, 8, 9. — This series illustrates the process of cleavage in the egg during the change from the two-celled to the four-celled stage. Magnified 385 diameters.

Fig. 10. — The four-celled stage, one hundred and ten minutes after fecundation. Side view. Magnified 385 diameters.

Figs. 11, 12. — The eight-celled stage, one hundred and forty-five minutes after fecundation. Magnified 385 diameters.

Fig. 13. — The sixteen-celled stage, one hundred and eighty-five minutes after fecundation. Side view. Magnified 385 diameters.

Fig. 14. — The thirty-two-celled stage, two hundred minutes after fecundation. Side view. Note large yolk cell. Magnified 385 diameters.

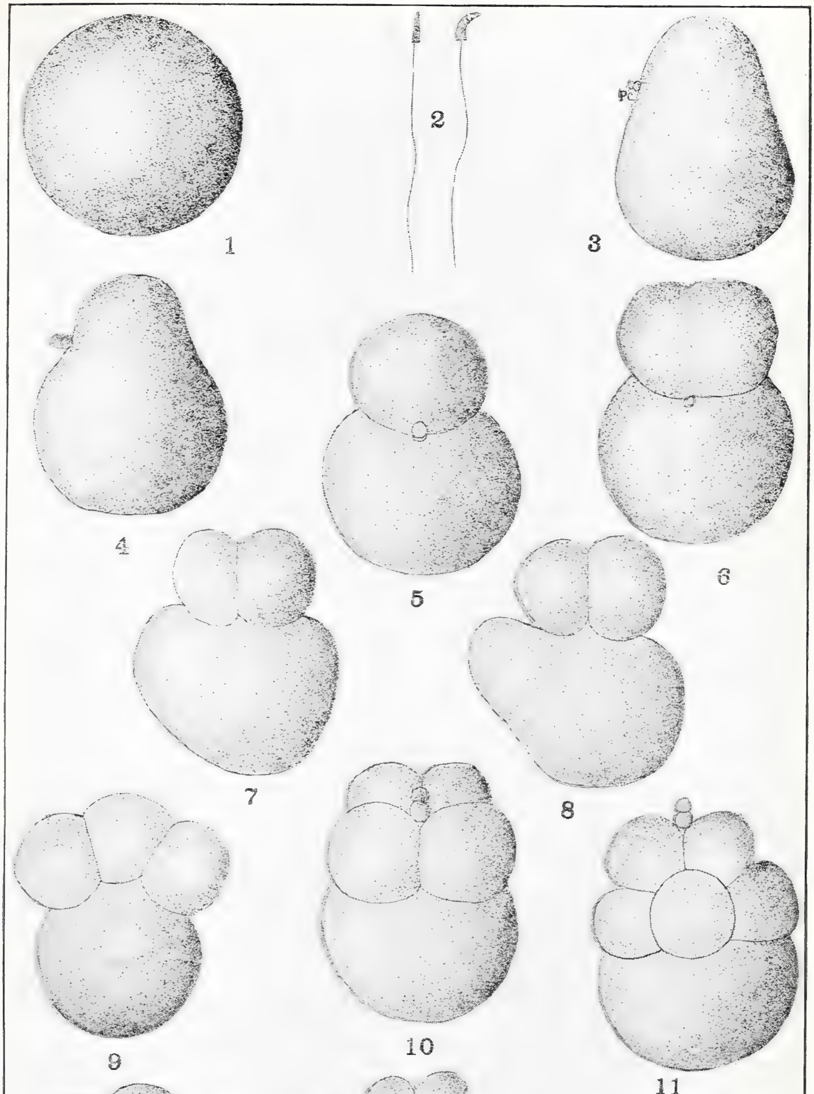
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Fig. 15. — Ciliated gastrula, ten hours after fecundation. The embryo can now swim through the water by means of hairlike cilia. The larger cells have become invaginated. Magnified 385 diameters.

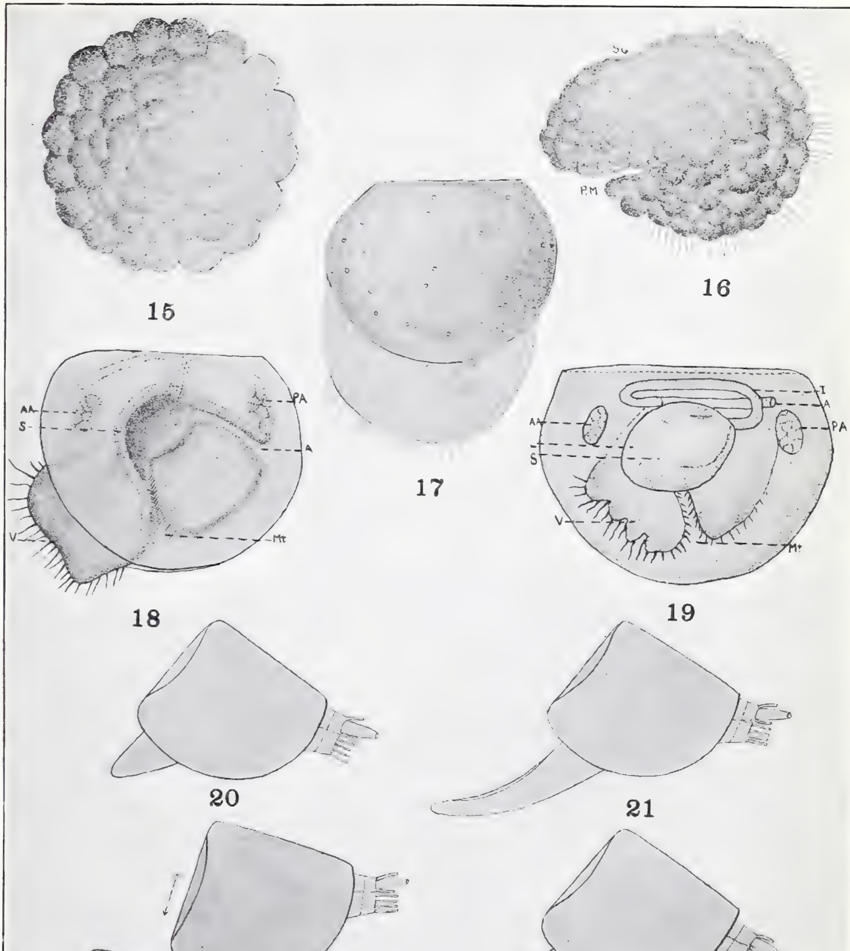
Fig. 16. — Trochosphere stage, twelve to fourteen hours after fecundation. The body has elongated and the cilia are now confined to the front end. The opening of the primitive mouth (pm) can be seen on the lower side, while above is a slight indentation corresponding to the beginning of the shell gland (sg). Magnified 385 diameters.

Fig. 17. — Formation of the shell, which arises at two symmetrical points of calcification, right and left of the median line, and gradually envelops the animal. Magnified 385 diameters.

Fig. 18. — Early veliger swimming with velum extended from the shell, about thirty-six hours after fecundation. aa, anterior adductor muscle, pa, posterior adductor muscle, s, stomach, a, anus, mt, mouth, v, velum. Magnified 385 diameters.

Fig. 19. — Veliger slightly older than shown in Fig. 18. The intestine (i) has elongated, and the liver (l) is more prominent.

Figs. 20-27. — Figs. 20–24 illustrate the ordinary method of crawling of the small 2 to 3 millimeter quahaugs. It consists of extending the foot and dragging the body in a forward direction. Fig. 20 shows the foot just appearing from the shell; the mantle and siphon are extended, while the angle between the shell and the foot is acute. Fig. 21 shows the foot extended to its full length. It has made a twist so that the bottom part of the ciliated tip can get a firm hold, and thus raise the animal on edge so that the shell can enter the sand with a cutting edge. In Fig. 22 the shell has taken a downward tip, the foot being partly withdrawn into the shell. Fig. 23 shows the animal at the completion of an upward tip, caused by the further withdrawal of the foot, which has straightened the shell into its original position. Figs. 24 and 27 show another method of crawling, the quahaug being forced backward by a forceful movement of the foot. In Figs. 24 and 26 the foot is turned under the shell until the tip finds a resting place; then by a jerky motion the shell is raised from the bottom and thrust either to the position of Fig. 25 on the same side or turned over on the opposite side (Fig. 27).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SG
P.M
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AA
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V
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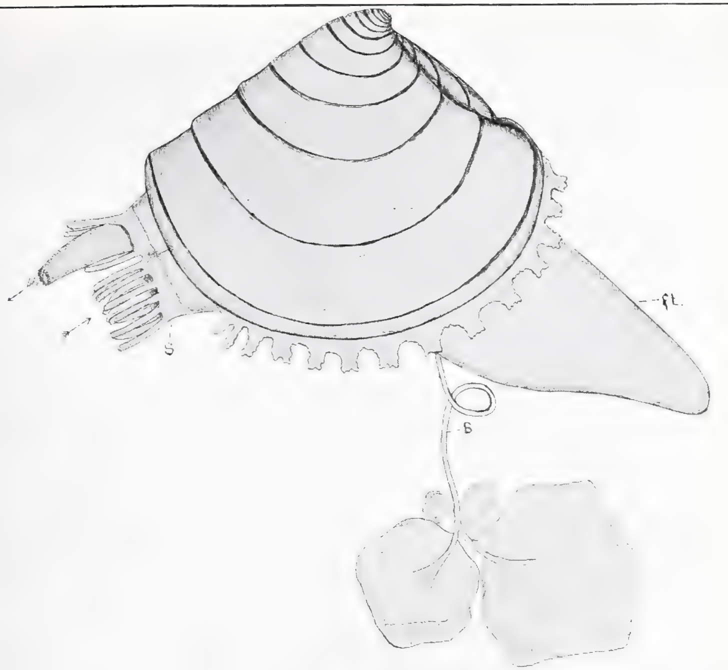
Fig. 28. — Young quahaug, 1 millimeter ($\frac{1}{25}$ inch) in length, attached to sand grains by the byssus (b). The siphon (s) consists of two parts, an incurrent encircled by twelve tentacles, through which the water enters the mantle chamber of the animal, and an excurrent with four tentacles and filmy telescopic tube, through which the water passes out of the mantle cavity. The byssus arises from a gland on the under side of the foot (ft).

Fig. 29. — Young quahaug, 1 millimeter in size, half buried in the sand. The animal is feeding, water passing in and out of the extended siphon, as shown by the arrows.



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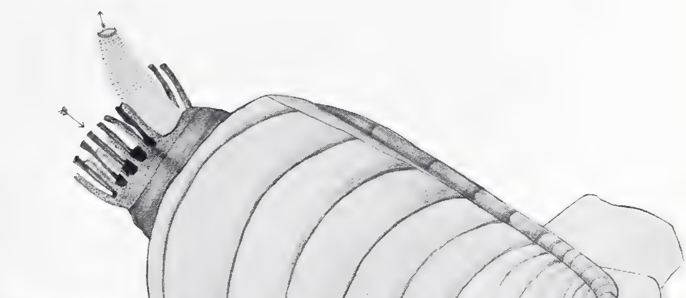

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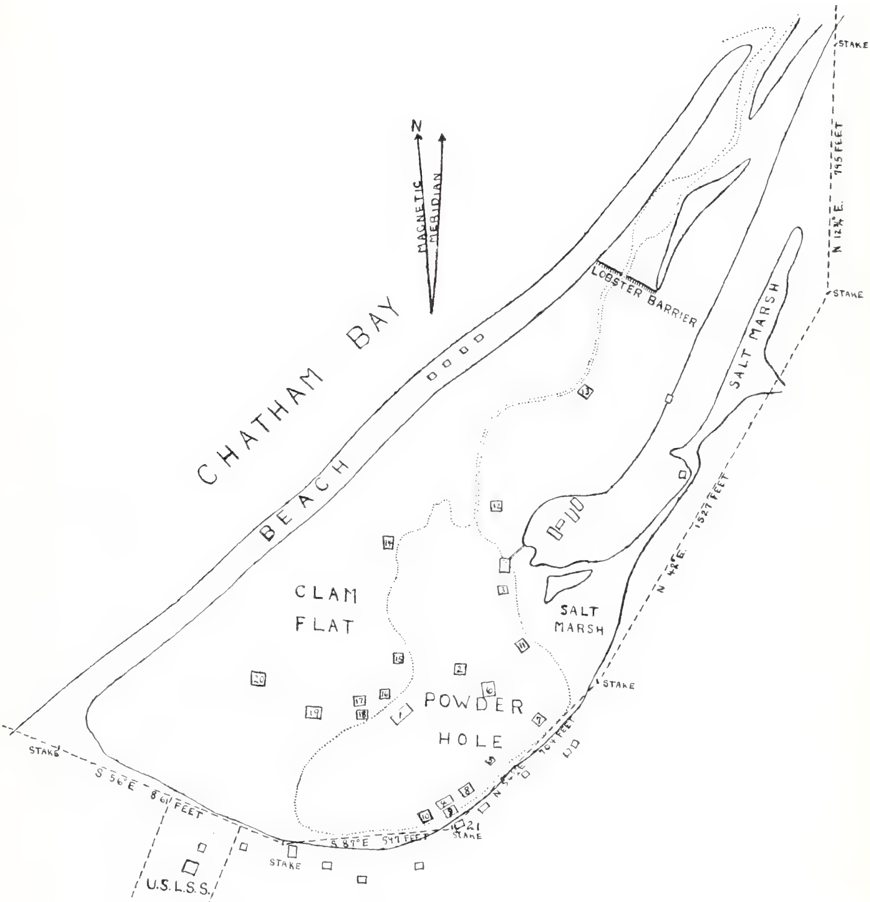
Fig. 30. — Map showing the distribution of the quahaug in Massachusetts. The black areas indicate ground where quahaugs are found.


NEWBURY PORT
GLOUCESTER
SALEM
LYNN
BOSTON
COHASSET
PLYMOUTH
PROVINCETOWN
WELLFLEET
ORLEANS
BREWSTER
WAREHAM
MARION
NEW BEDFORD
FALL RIVER
BOURNE
BARNSTABLE
HARWICH
CHATHAM
FALMOUTH
WEST PORT
MARTHAS VINEYARD
NANTUCKET

Fig. 31. — Plan of the Powder Hole, Monomoy Point, Mass., showing the shellfish experiments and laboratory of the Massachusetts Department of Fisheries and Game. The harbor, represented by the dotted lines, is bounded on the north and west by a clam flat of coarse sand. The channel connecting the Powder Hole with the ocean passes across this flat. The deepest water, 18 feet, is found near the clam flat, while in the eastern and southern parts of the harbor the shallow water is filled with a thick growth of eelgrass. (1) Raft; (2) car in which egg lobsters were confined for hatching purposes; (3) scallop pen; (4) scallop pen; (5) scallop pen; (6) winter rack for suspending scallop baskets and quahaug boxes under water as a protection from the ice; (7) quahaug bed No. 3; (8) quahaug bed No. 5; (9) quahaug bed No. 7; (10) quahaug bed No. 6; (11) quahaug bed No. 8; (12) clam bed No. 19; (13) sea clam bed; (14) clam bed No. 18; (15) clam bed No. 3; (16) clam bed No. 2; (17) clam bed No. 99; (18) clam bed No. 100; (19) clam bed No. 20; (20) clam bed No. 1; (21) laboratory.



N
MAGNETIC MERIDIAN
CHATHAM BAY
BEACH
CLAM FLAT
POWDER HOLE
SALT MARSH
SALT MARSH
LOBSTER BARRIER
STAKE
STAKE
STAKE
STAKE
STAKE
STAKE
N 12¾° E. 795 FEET
N 42° E. 1527 FEET
S 56° E 861 FEET
S 87° E 597 FEET
U.S.L.S.S.

Fig. 32. — Map of Wellfleet Bay showing the location between the tide lines of quahaug growth experiments 101 to 185. Many acres of flats are exposed, owing to the large rise and fall of the tide, which is about $10\frac{3}{4}$ feet. The average increase in volume for 84 beds in one year was 185 per cent., or over $2\frac{3}{4}$ bushels for every bushel planted.

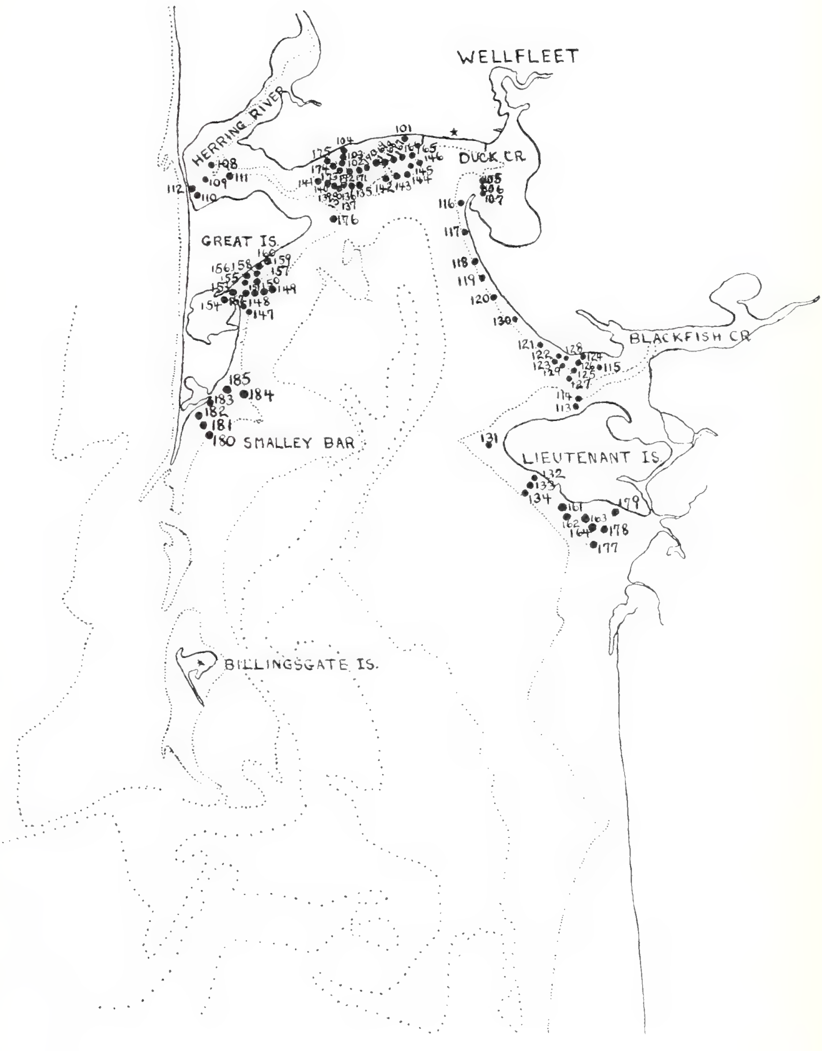
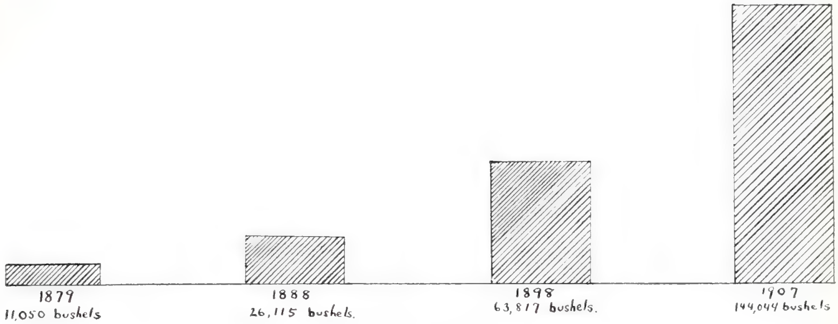

WELLFLEET
HERRING RIVER
DUCK CR.
GREAT IS.
BLACKFISH CR.
SMALLEY BAR
LIEUTENANT IS.
BILLINGSGATE IS.

Fig. 33. — The increase in quahaug production for Massachusetts from 1879 to 1907 is represented by a series of columns, corresponding to the annual yield for 1879, 1888, 1898 and 1907. The figures for the first three years are taken from the reports of the United States Bureau of Fisheries.

Fig. 34. — The increase in value for the annual production of these years is similarly represented.

Fig. 35. — The rise in price per bushel for these years illustrates that the increased demand and high cost of living have made quahauging a remunerative business, in spite of the fact that the daily yield of the individual quahauger has become less.



Production

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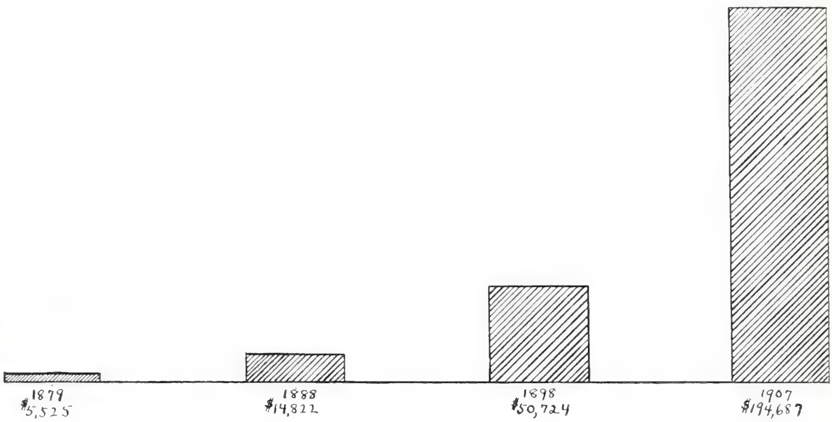


Value of Production

34

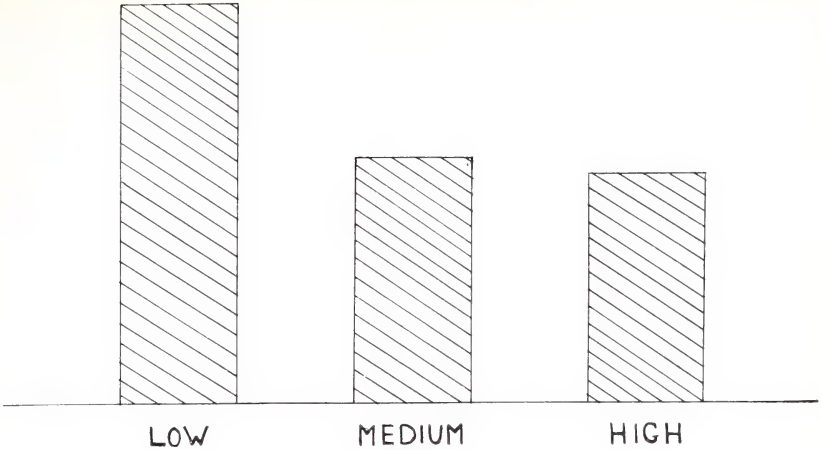
Rise in Price per Bushel

35

Fig. 36. — Growth between the Tide Lines. — Eighty beds, planted between the tide lines at Wellfleet, were classified as *low*, *medium* and *high*, according to the length of time exposed. The *low* beds, 32 in number, having a better circulation and longer feeding period, gave a growth of 12.5 millimeters (.49 inch) in one year; the 27 *medium* beds gave 7.82 millimeters (.31 inch); and the 21 *high* beds showed a gain of 7.17 millimeters (.28 inch). Considering the growth of the *low* beds as 100 per cent., the *medium* would show 61.53 per cent., and the *high* 57.39 per cent.

Fig. 37. — Age and Growth. — With age the rate of growth both in actual increase and gain in volume becomes less. The three columns represent the comparative annual increase in length of 21.2 millimeters (.83 inch), 10.5 millimeters (.41 inch) and 5 millimeters (.20 inch) for quahaugs one and one-half, three and one-half, and five and one-half years old, planted in boxes suspended from a raft at Monomoy Point.

Fig. 38. — Current and Growth. — The three columns represent the comparative increase in length during 1909 for small quahaugs planted in three sections of the Powder Hole. The highest column shows the average growth 27.23 millimeters (1.07 inches), in the raft boxes, where the circulation of water was good; the second column shows a growth of 19.44 millimeters (.77 inch) in boxes near the south shore of the Powder Hole, in front of the laboratory, where there is a slight current; the third column shows a growth of 14.94 millimeters (.59 inch) in boxes near the southeast shore, where there was practically no circulation, owing to the thick eelgrass.



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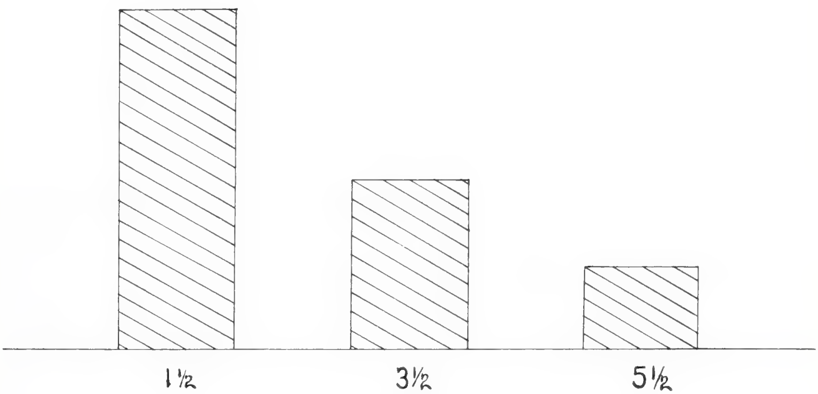

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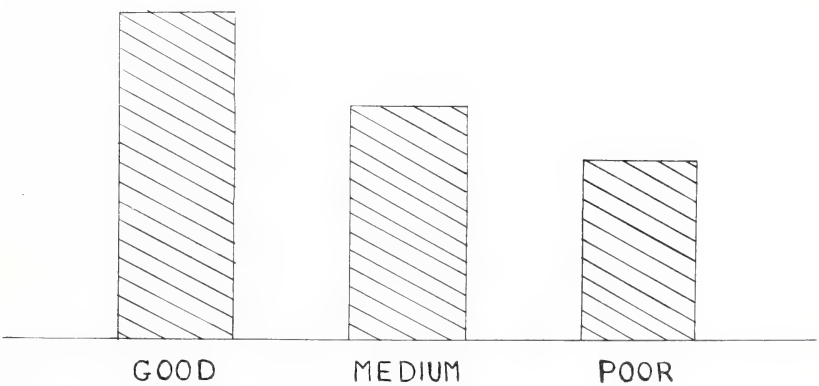

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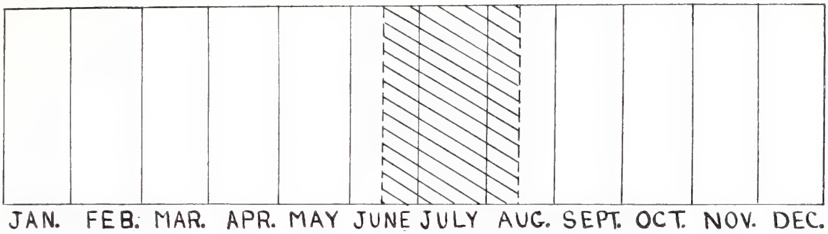
Fig. 39. — The Spawning Months. — The spawning season lasts from the middle of June to the middle of August. This period is represented by the shaded portion.

Fig. 40. — The Growing Months. — The quahaug increases in size of shell only during the summer months, growth ceasing during the cold weather. The shaded portion represents the period of growth.

Fig. 41. — The Relative Value of the Growing Months. — The quahaug does not increase with equal rapidity during the seven months of growth. The relative value of these months is represented in terms of the increase during each month for a standard quahaug. Considering the total annual growth as 100 per cent., the following are the values for the individual months: May, 3.78 per cent.; June, 10.81 per cent.; July, 19.02 per cent.; August, 25.56 per cent.; September, 26.24 per cent.; October, 12.85 per cent.; November, 1.74 per cent.

Fig. 42. — The Food Value. — The relative proportion, by weight, of the various parts of an average quahaug of 70 millimeters (2.75 inches) is represented by a series of columns. (1) Total weight, 100 per cent.; (2) shell, 62.47 per cent. (3) meat, 13.57 per cent.; (4) fluid, 23.96 per cent.



SPAWNING MONTHS

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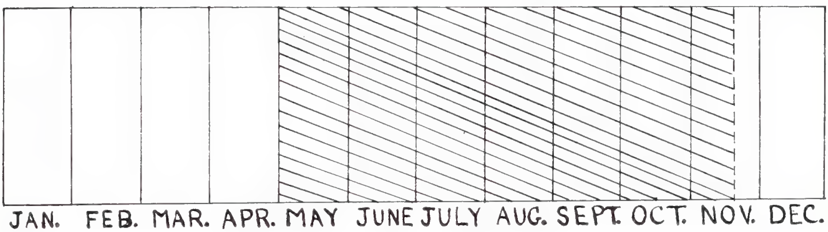
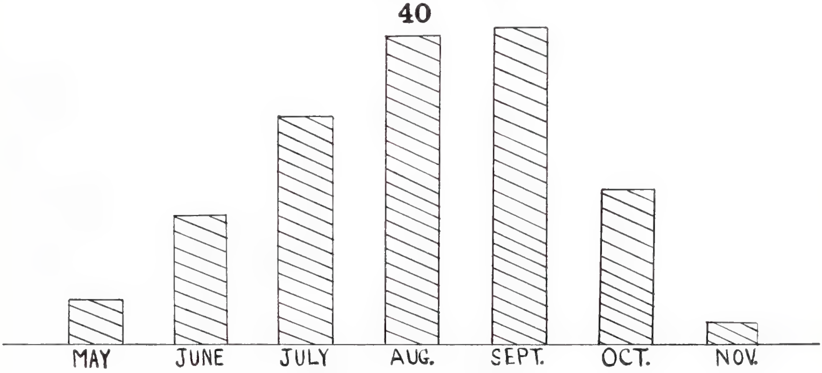


GROWING MONTHS

40



RELATIVE VALUE OF GROWING MONTHS

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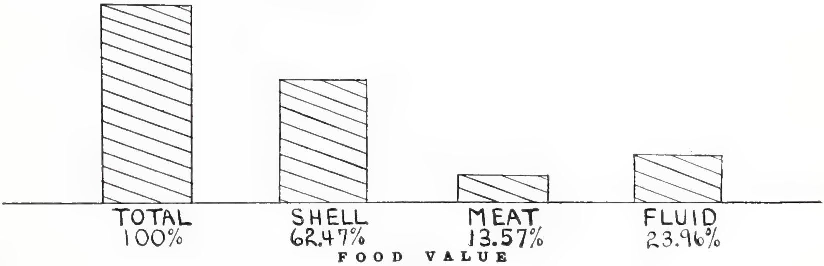


FOOD VALUE

42

Fig. 43. — Growth of a standard 25 millimeters (1 inch) quahaug for fourteen months, showing the cessation of growth during cold weather: —

	Millimeters.
May 1,	25.00
June 1,	26.00
July 1,	28.80
August 1,	33.50
September 1,	39.20
October 1,	44.40
November 1,	46.70
December 1,	47.00
January 1,	47.00
February 1,	47.00
March 1,	47.00
April 1,	47.00
May 1,	47.00
June 1,	47.65
July 1,	49.47

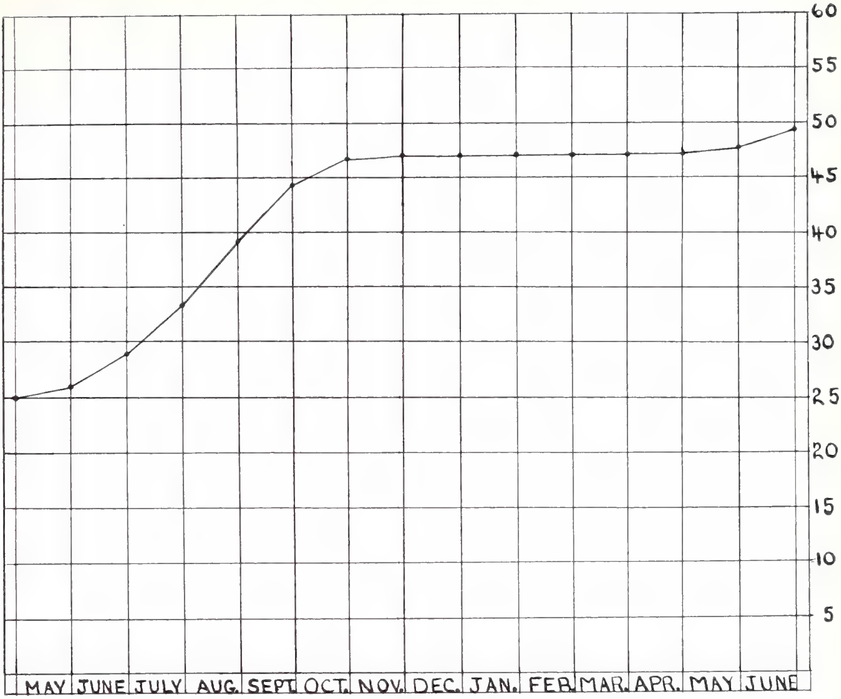
Fig. 44. — Growth for Four Years. — The growth of the average quahaug from two series of experimental beds is here given for a period of four years, starting with a quahaug of 5 millimeters ($\frac{1}{5}$ inch) at the age of one-half year. Note the difference between the rapid growth at Monomoy Point and the slower Wellfleet beds, also the decrease in the rate of growth as the quahaug increases in size.

Growth in the Raft Boxes at Monomoy Point (Millimeters).

Month.	First Year.	Second Year.	Third Year.	Fourth Year.
January 1,	5.00	28.73	49.11	62.66
February 1,	5.00	28.73	49.11	62.66
March 1,	5.00	28.73	49.11	62.66
April 1,	5.00	28.73	49.11	62.66
May 1,	5.00	28.73	49.11	62.66
June 1,	5.73	29.50	49.62	63.03
July 1,	7.93	31.70	51.08	64.10
August 1,	12.42	35.58	53.66	65.98
September 1,	19.17	40.79	57.12	68.51
October 1,	25.59	46.14	60.68	71.11
November 1,	28.38	48.76	62.42	72.38
December 1,	28.73	49.11	62.66	72.55
Annual gain,	23.73	20.38	13.55	9.89

Growth between the Tide Lines in Wellfleet Harbor (Millimeters).

Month.	First Year.	Second Year.	Third Year.	Fourth Year.
January 1,	5.00	16.21	27.48	36.69
February 1,	5.00	16.21	27.48	36.69
March 1,	5.00	16.21	27.48	36.69
April 1,	5.00	16.21	27.48	36.69
May 1,	5.00	16.21	27.48	36.69
June 1,	5.51	16.72	27.90	37.04
July 1,	6.94	18.16	29.07	38.01
August 1,	9.33	20.57	31.04	39.64
September 1,	12.23	23.49	33.42	41.61
October 1,	14.89	26.15	35.60	43.41
November 1,	16.06	27.33	36.56	44.21
December 1,	16.21	27.48	36.69	44.31
Annual gain,	11.21	11.27	9.21	7.62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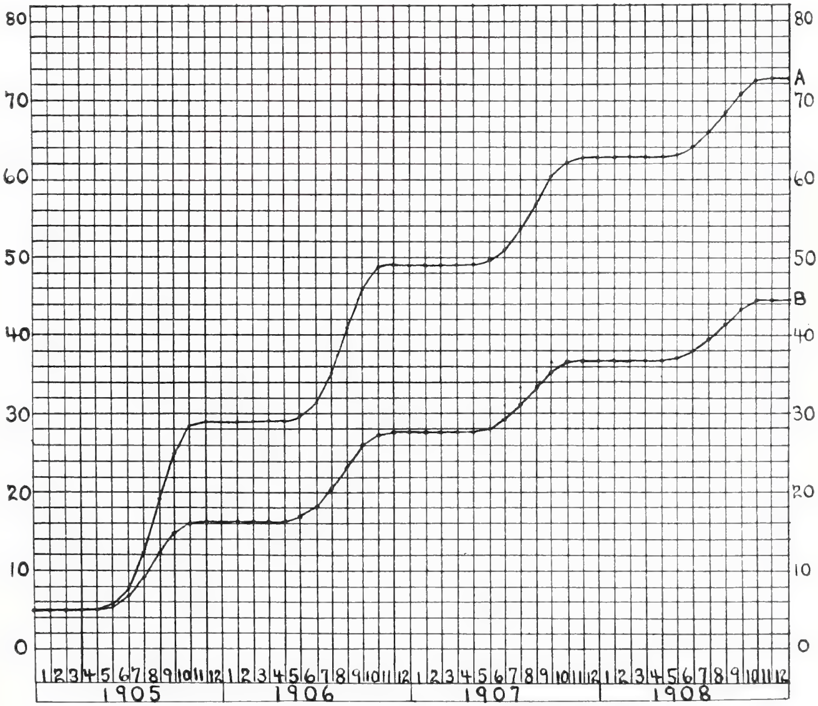
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1906
1907
1908

44

Fig. 45. — The growth of a quahaug in the raft boxes, Monomoy Point, from one and one-half to five and one-half years old, is shown with the corresponding increase in volume. Starting with 1 bushel of one and one-half-year-old quahaugs there would result at the age of five and one-half years approximately 19 bushels. The figures on the left give the size of the quahaug (reduced one-half); those on the right represent the volume in bushels corresponding to the various years.

Age (Years).	Size.		Volume (Bushels).
	Millimeters.	Inches.	
One and one-half,	28.73	1.13	1.00
Two and one-half,	49.11	1.93	4.44
Three and one-half,	62.66	2.47	9.10
Four and one-half,	72.55	2.86	14.04
Five and one-half,	79.90	3.18	18.96

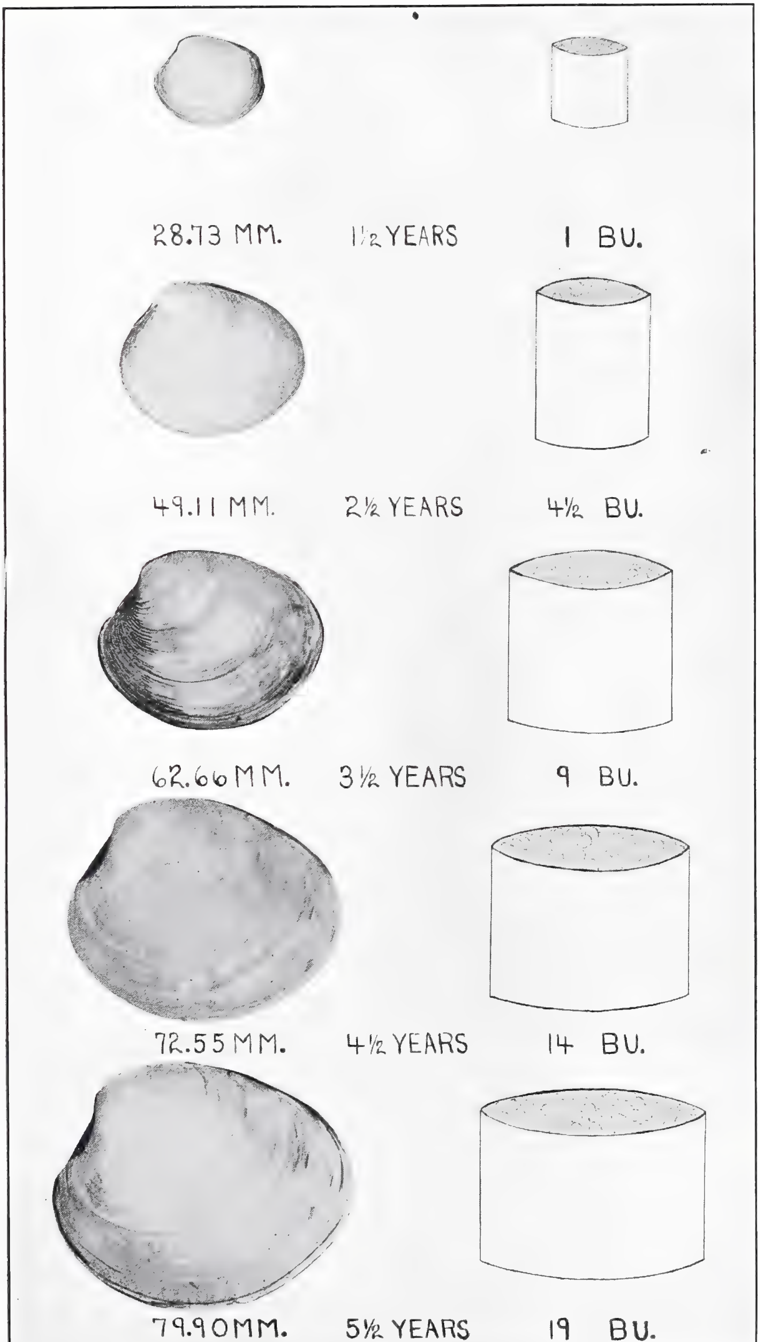
28.73 MM. 1½ YEARS 1 BU.
49.11 MM. 2½ YEARS 4½ BU.
62.66 MM. 3½ YEARS 9 BU.
72.55 MM. 4½ YEARS 14 BU.
79.90 MM. 5½ YEARS 19 BU.

Fig. 46. — Diagram of the method used in experimental hatching of quahaug eggs and rearing of the young larvæ at the Wellfleet laboratory. It represents a cross-section of the laboratory, showing a small $1\frac{1}{2}$ horse power gasolene engine (B), connected by a belt with a pump (C), by which salt water is forced from below into a tank (A) situated near the roof. The laboratory is located on a wharf over the water, which enables salt water to be obtained directly from beneath the floor. The inlet of the pump is guarded by a strainer (H), which prevents seaweed entering the pipe. From the tank the salt water is conducted through the laboratory by a large pipe set with small petcocks. From these petcocks pieces of rubber tubing (F) lead to the hatching tubs (E), which consist of half barrels fitted with sand filters (D). The tubs are placed over a sink (G) which carries off the filtered water. By this arrangement a continuous flow of water is established through the hatching tanks.

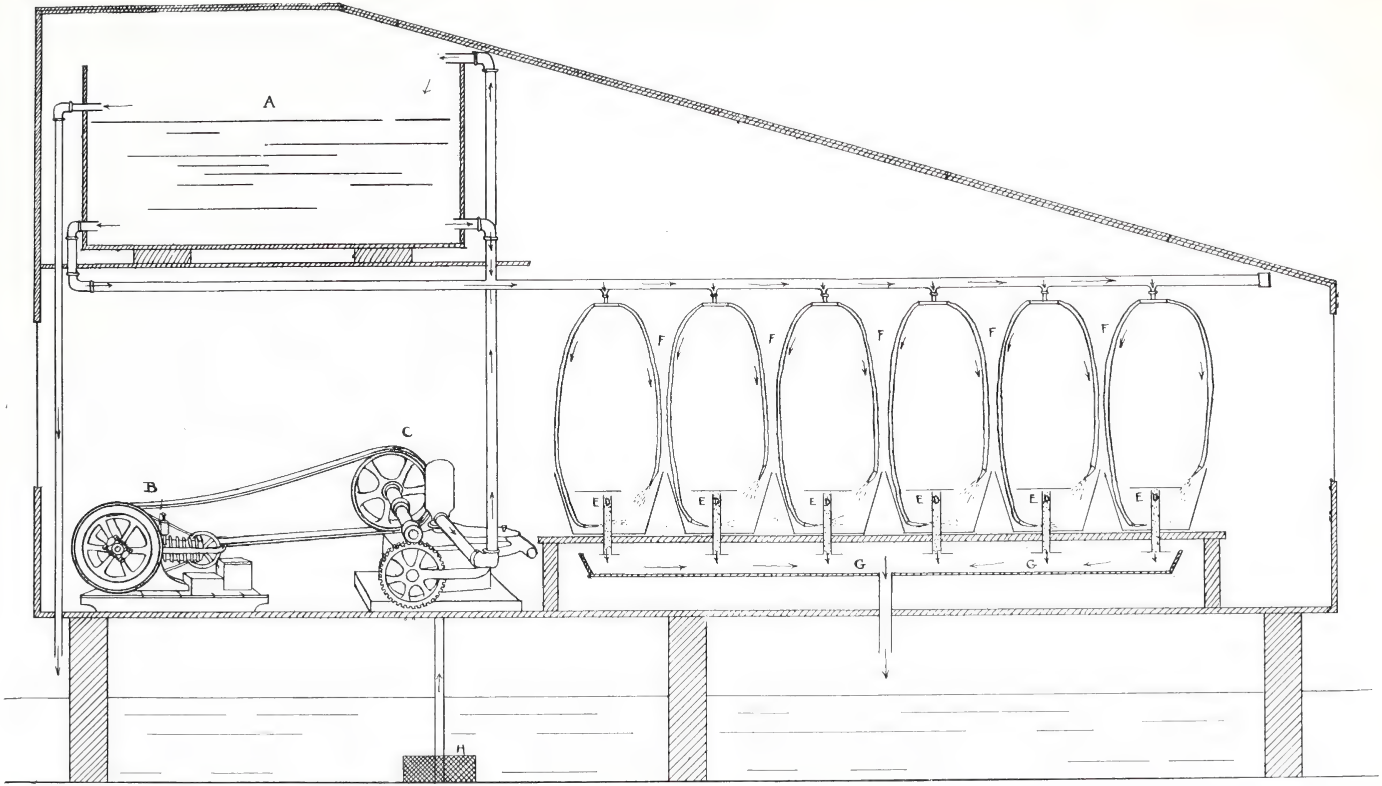

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Fig. 47. — Photograph taken from a model in the Museum of Natural History in New York. The different portions of the anatomy are indicated by the labels, The symbol A. A. and P. A. refer to the anterior and posterior adductor muscles. which hold the two valves of the shell together. The posterior part of the animal is represented by the siphon, which consists of two parts, an incurrent and an excurrent, through which the water enters and leaves the quahaug in the directions indicated by the arrows. In the mantle chamber the food is filtered from the water by the gills, which are here shown cut off near their base.

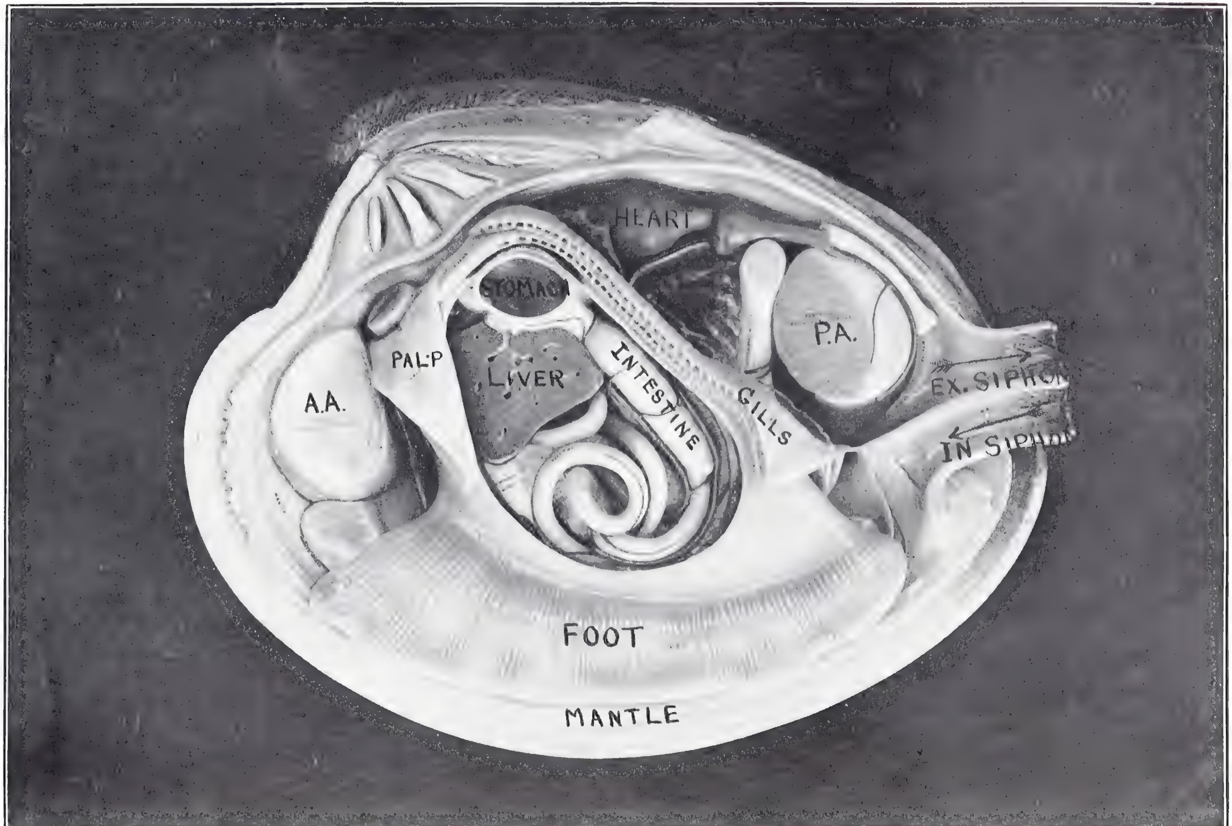
HEART
STOMACH
P.A.
PAL.P
LIVER
INTESTINE
GILLS
A.A.
FOOT
MANTLE

Fig. 48. — The exterior of the laboratory at Wellfleet, showing the hatching tubs. This building, formerly an oyster house situated on the Chequesset Inn wharf, was provided in 1908 for the use of the department by Mr. L. D. Baker of Wellfleet. One large room, 20 by 30 feet, is used for the laboratory, while two small rooms adjoining are utilized for sleeping quarters. The situation over the water affords satisfactory facilities for experimental work on sea forms.


Mass. Department of Fisheries
SHELLFISH LABORATORY

Fig. 49. — The quahaug farm of Z. A. Howes at Wellfleet. Several hundred bushels of seed quahaugs are planted between the tide lines. The boundaries of the grant are marked with stakes, made of slender saplings topped with brush. The man in the foreground is examining the growth of the quahaugs.

Fig. 50. — Small grants for the bedding of the catch at Wellfleet. Under the Acts of 1904 the inhabitants of Eastham, Orleans and Wellfleet have the privilege of staking off not over 75 feet square of flat for bedding the catch, when the prices are low. During dull seasons many bushels of "blunts" are planted until the price becomes satisfactory. This may be termed the first step toward quahaug culture. Note the quahaugs in the center, which are still uncovered.

Fig. 51. — One of the boxes suspended from the raft at Monomoy Point when taken up at the end of the summer. The quahaugs which have been growing in the box are shown in front. On careful examination the notches in the shell, marking growth for three years, can be seen. The box and rope are covered with barnacles and silver shells (*Anomia*), while the wood has been perforated by a boring mollusk, the shipworm (*Teredo*). This illustrates an easy method of obtaining the rate of growth of the quahaug.

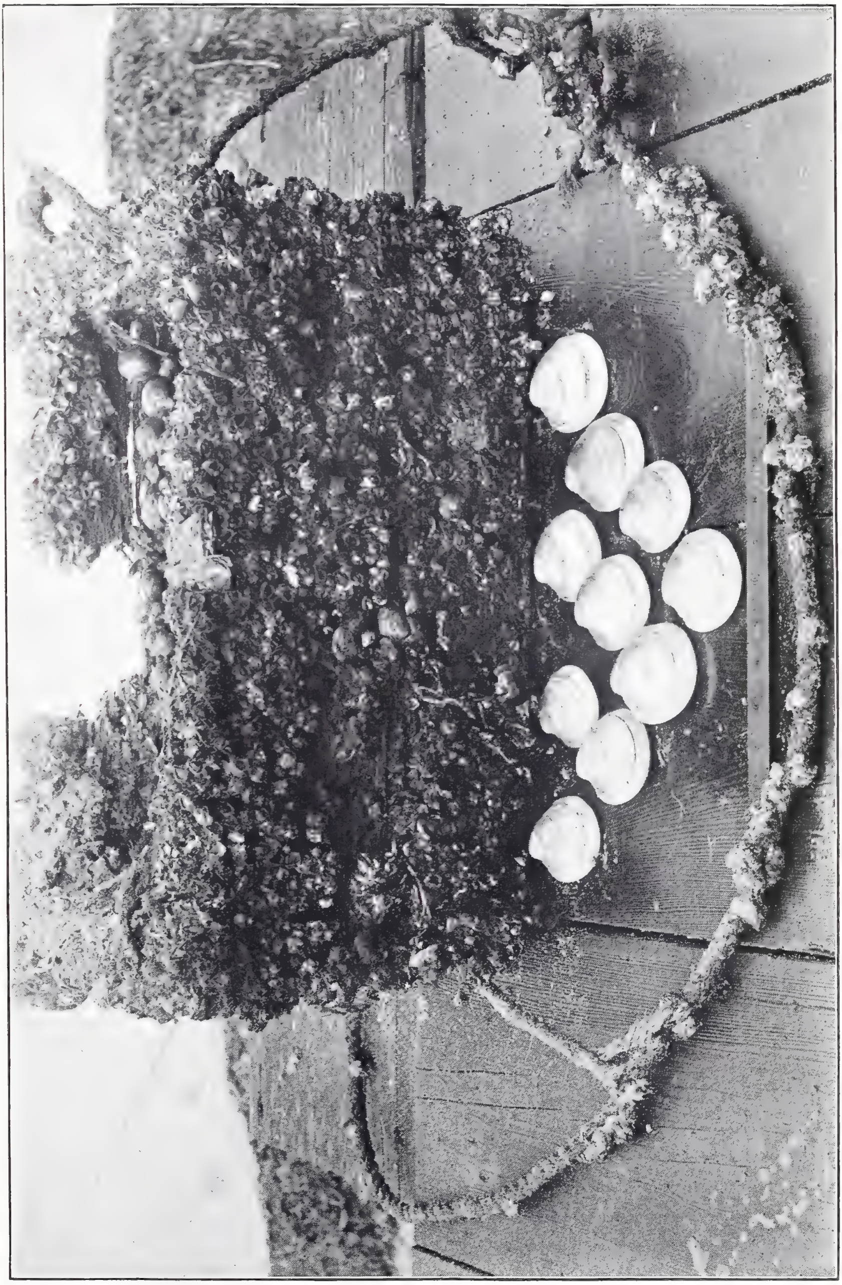

Fig. 52. — These two sizes illustrate the stimulating effect on growth of current, which acts as a food carrier. In each bed quahaugs of the same size were planted and allowed to remain for three years. The larger quahaugs were planted in a box on the raft, where the circulation of water was good; the smaller in the south-eastern corner of the Powder Hole, not 75 yards from the raft, in shallow water among thick eelgrass, which shut off all circulation.

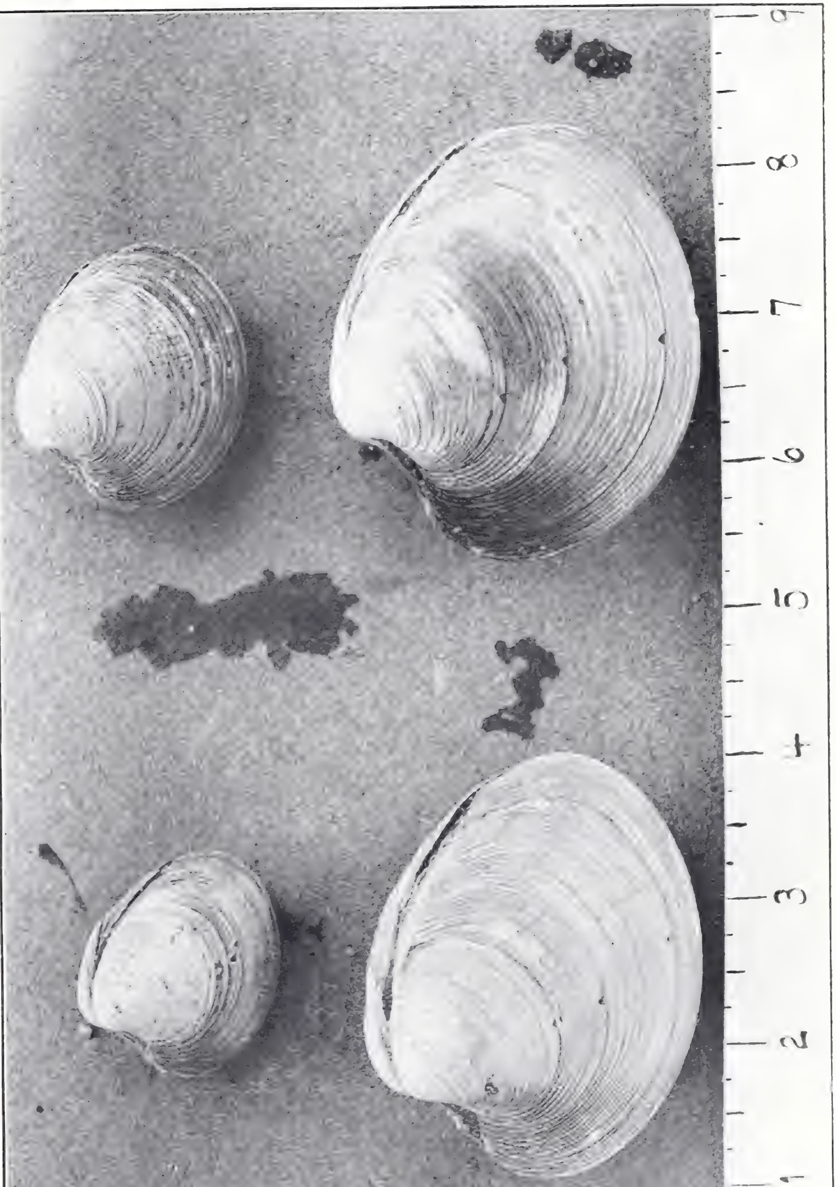
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Fig. 53. — Quahaugs from an experimental bed at Monomoy Point, showing two years' growth. The two notches or file marks on the shells indicate the growth per year. The photograph is two-thirds life size. These quahaugs show rapid growth, having gained nearly 1 inch in length per year.

Fig. 54. — The principal enemy of the adult quahaug is the common winkle or cockle (*Lunatia duplicata* or *heros*), pictured at the right and left in the illustration. In the corners are quahaug shells, through which a clean countersunk hole has been bored by this mollusk at the umbo. In the center is a starfish, the great pest of the oyster beds, and on rare occasions an enemy of the quahaugs.

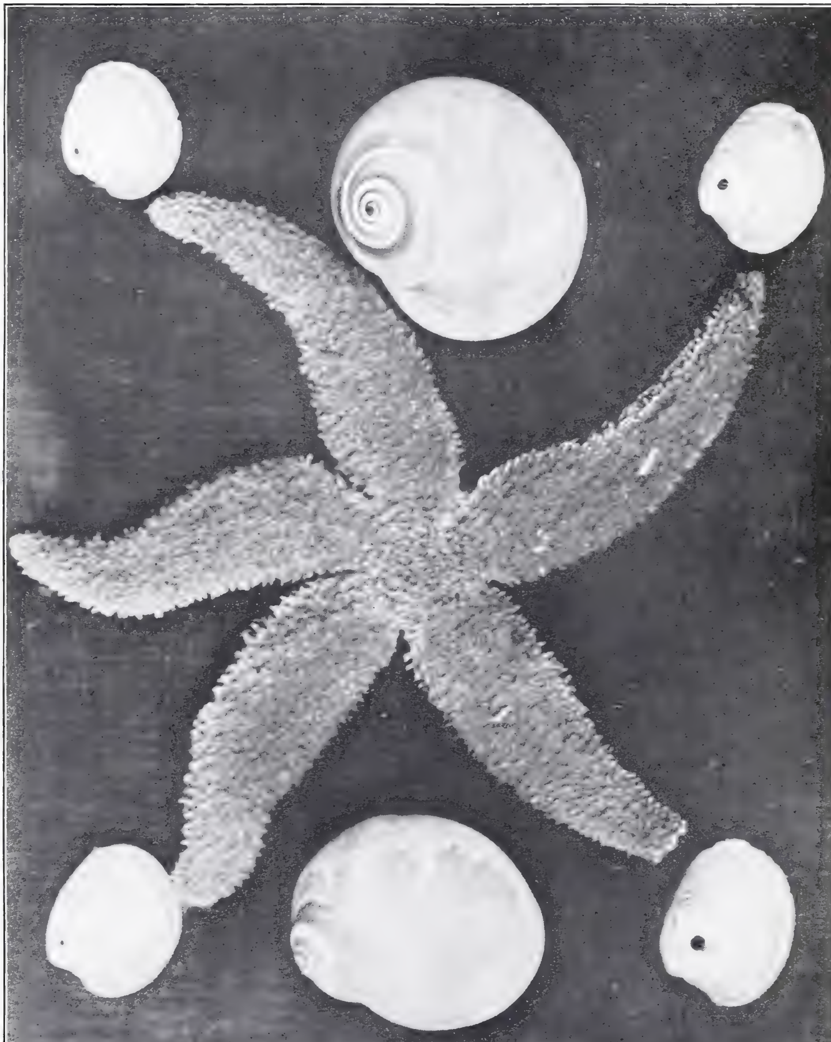


Fig. 55. — Scene along the river front at Fairhaven, showing a quahaug shanty and several skiffs, which are used in raking the small seed quahaugs from the Acushnet River. Owing to the pollution within the restricted area, quahaugs can only be taken from this river for transplanting purposes. Since writing this report an act was passed in 1911 whereby the city of New Bedford and the town of Fairhaven by a common board govern the taking of quahaugs from this section by licenses and by restrictions as to selling and transplanting.

Fig. 56. — The quahaug house of the firm of A. D. Davis & Co. at Wellfleet in 1907, one of the receiving agencies for the Wellfleet fishermen. A typical quahauging boat of Wellfleet is shown, waiting to unload its cargo of quahaugs. The long handles of the rakes can be seen on the deck of the boat.

Fig. 57. — The Wellfleet quahauging fleet at their moorings in Duck Creek. Practically all these boats are equipped with gasolene engines, a common type being power cat boats without masts.

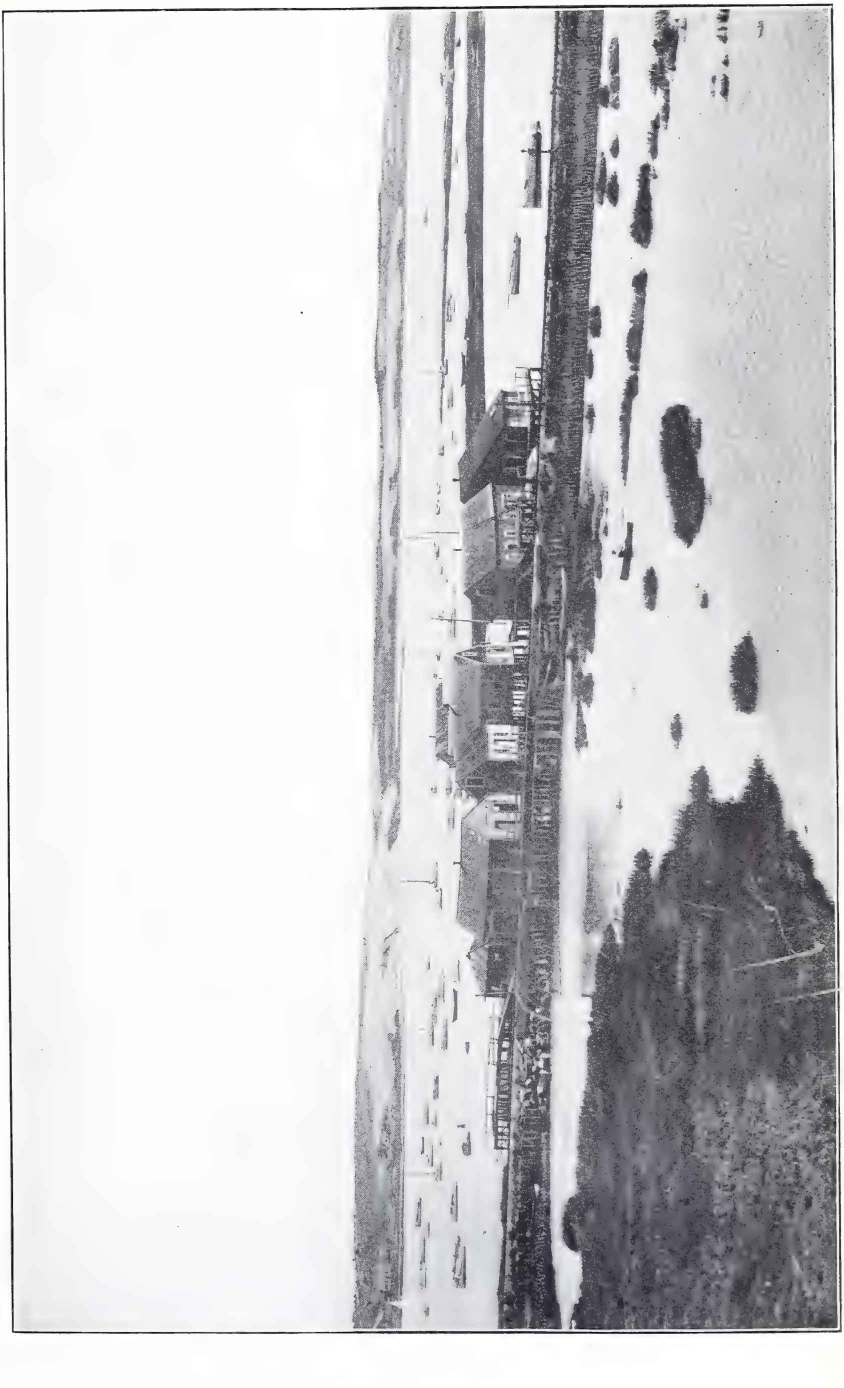


Fig. 58. — Basket rake covered with fine meshed wire netting, used at New Bedford and Fairhaven in the capture of the small seed quahaugs in the Acushnet River.

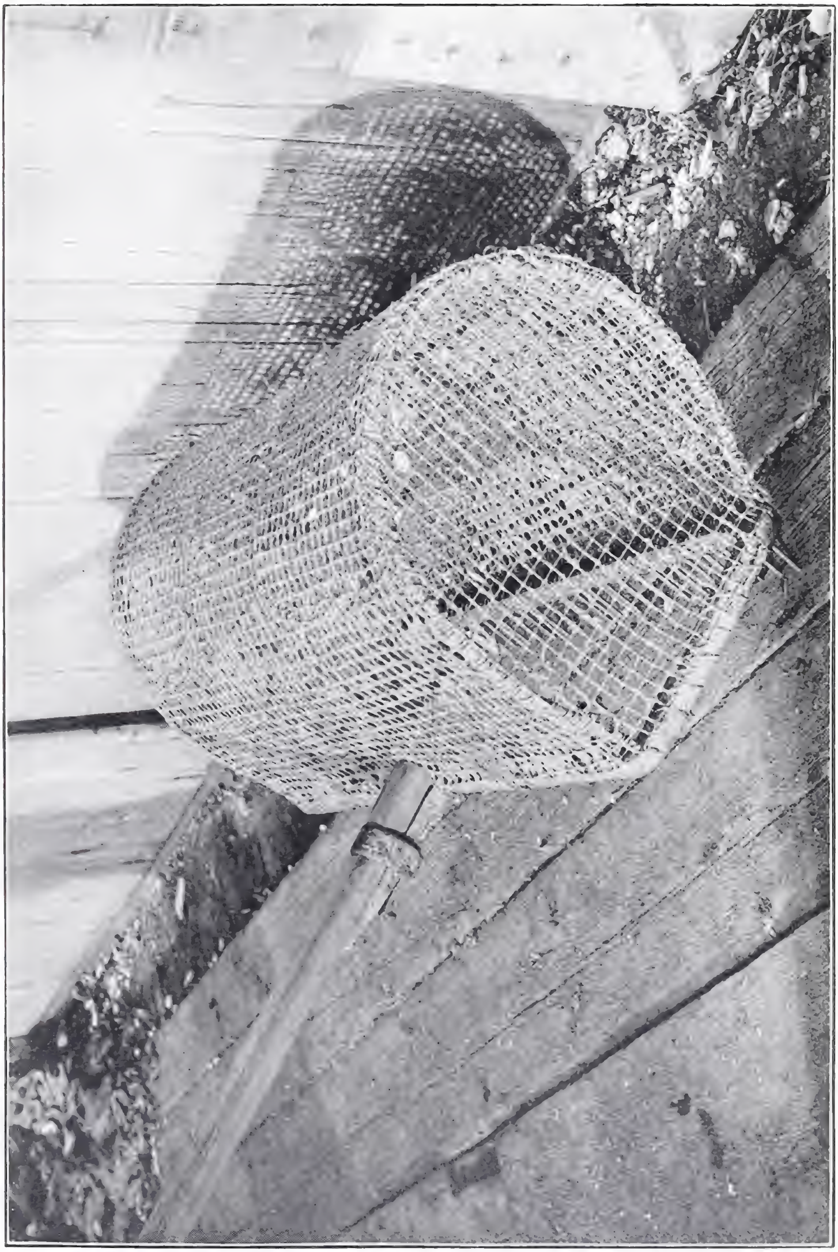


Fig. 59. — The type of basket rake used for deep water quahauging on Cape Cod. It consists of an iron framework, forming a curved bowl, the under edge of which is set with thin steel teeth varying in length from 2 to 4 inches, though usually $2\frac{1}{2}$ inch teeth are preferred. Over the bowl of this rake, which is strengthened by side and cross pieces of iron, is fitted a twine net, which, like the net of a scallop dredge, drags behind the framework. An average rake has from 19 to 21 teeth and weighs from 15 to 20 pounds.

Fig. 60. — The Claw Quahaug Rake. — This rake varies greatly in size and length. Its use is chiefly confined to Nantucket. The general style has a handle 6 feet long, while the iron part, in the form of a claw or talon, with prongs 1 inch apart, is 10 inches wide. A heavier rake, as here shown, is sometimes used in the deeper water.

Fig. 61. — This style of basket rake is used at Edgartown and Nantucket. The whole rake is made of iron, no netting being required, as thin iron wires $\frac{1}{3}$ of an inch apart encircle lengthwise the entire basket, preventing the escape of any marketable quahaugs, while at the same time allowing mud and sand to wash out. This rake has 16 steel teeth, $1\frac{1}{2}$ inches long, fitted at intervals of 1 inch on the scraping bar. The depth of the basket is about 8 inches. Short poles not exceeding 30 feet in length are used, as the raking is carried on in water which does not exceed 25 feet in depth. Only the iron framework of the rake is shown.

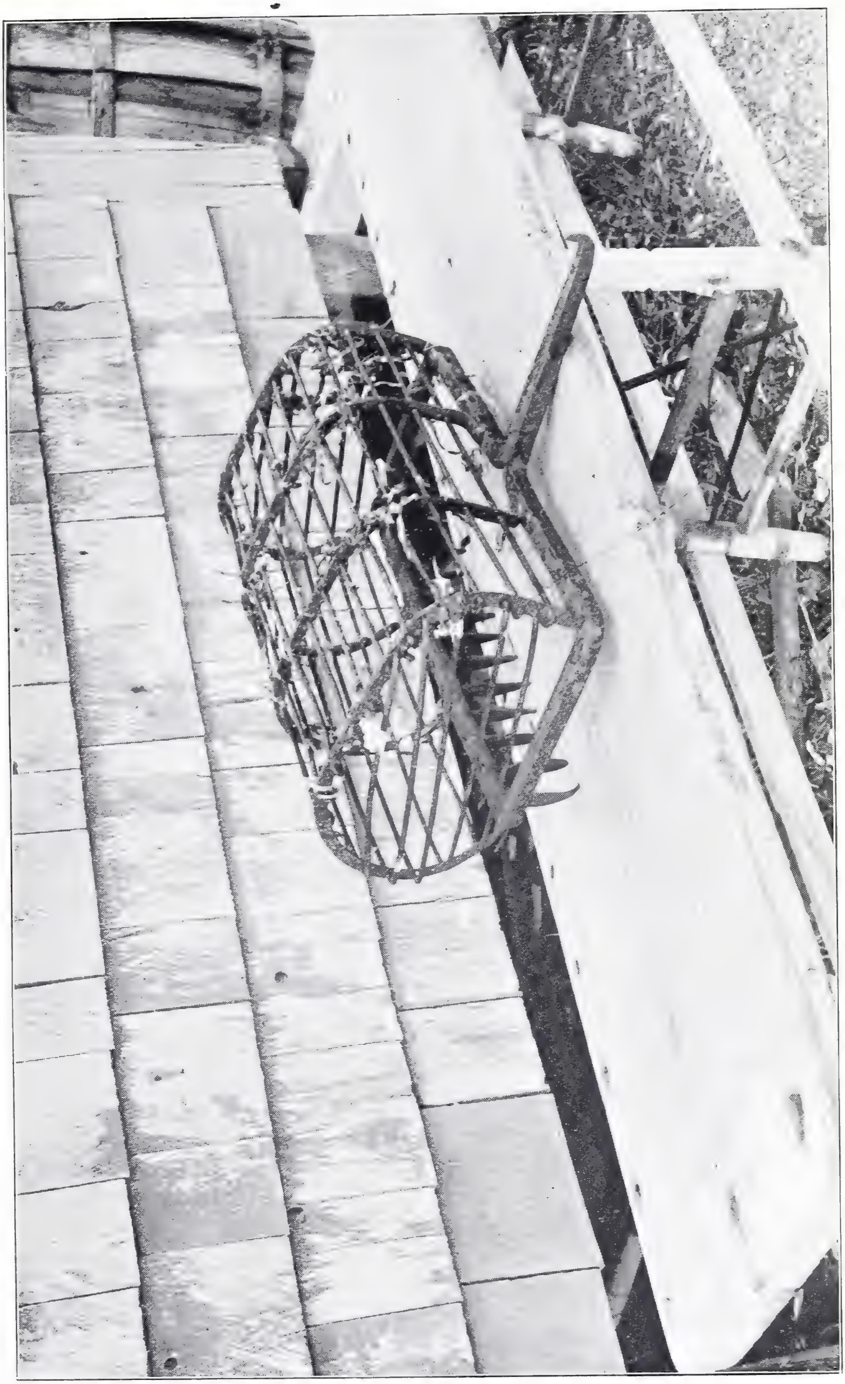
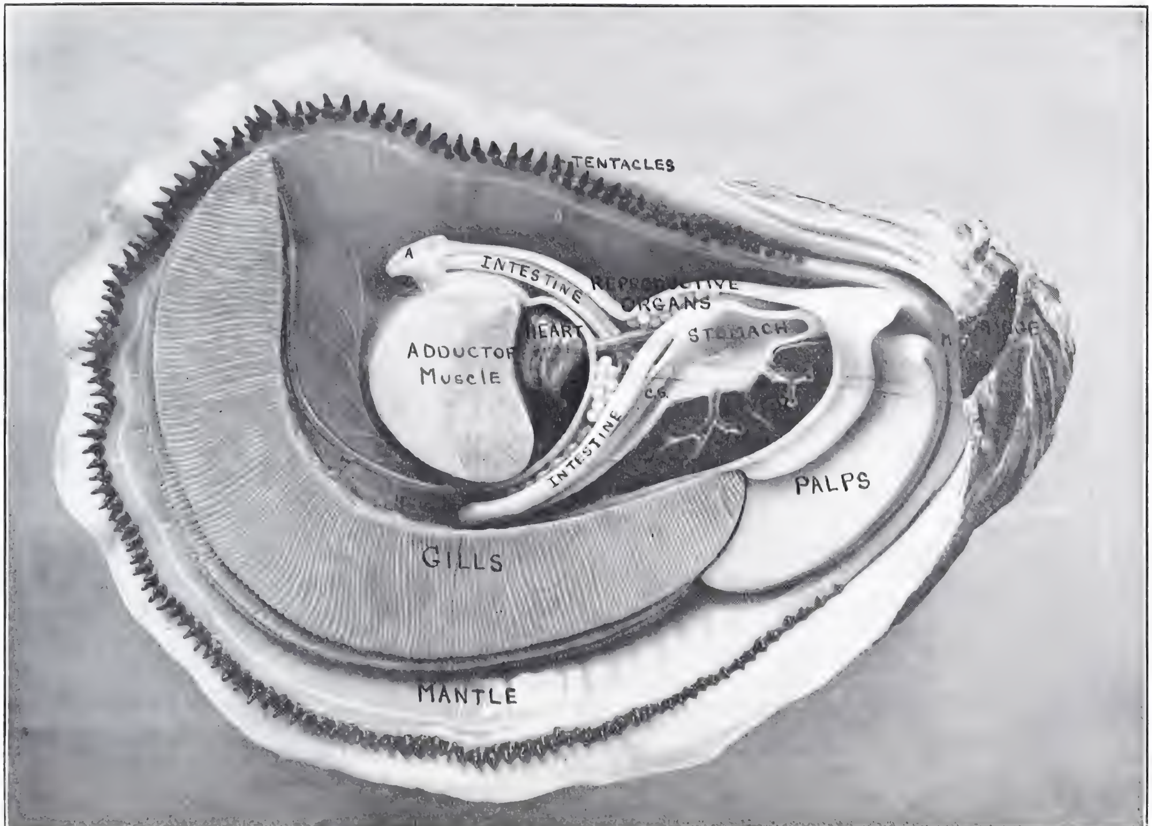


Fig. 62. — Anatomy of the Oyster. — From a model in the American Museum of Natural History. The right valve and mantle have been removed to show the internal organs. The oyster may roughly be likened to a book, the valves of the shell representing the cover, the fleshy mantle closely lining the shell the first and last leaves, and the gills, running lengthwise beneath the large adductor muscle, the inner pages. Between the muscle and the hinge lies the heart, and above the gills the visceral mass, consisting of the cream-colored reproductive organs, which are here pictured as round white masses, and the dark-colored digestive organs. Between the anterior end of the gills and the hinge are the palps, four fleshy flaps, similar in appearance to the gills. The microscopic plants which form the food of the oyster are filtered out by the hairlike cilia of the gills, transferred to the palps, and passed into the mouth. A short œsophagus leads into the stomach, which is surrounded by a dark-green gland, the liver. The intestine passes backward, then folds on itself just below the adductor muscle, passes forward to form a second coil, before it again leads backward, to end above the heart and adductor muscle.



TENTACLES
A
INTESTINE
REPRODUCTIVE
ORGANS
HEART
STOMACH
ADDUCTOR
Muscle
C.G.
INTESTINE
PALPS
GILLS
MANTLE

Fig. 63. — The buildings of the Sea Coast Oyster Company at Wellfleet in 1910. The two boats lying at the wharf are typical gasolene oyster dredgers, by means of which the shells are put down for the capture of spat, the grounds are cleared, the seed is planted and the oysters gathered for market.

Fig. 64. — Herring River, Wellfleet, at low water, showing the shells planted for the capture of seed oysters in 1908 on the gravel bar north of Great Island. The shells and pebbles are covered with spat.

Fig. 65. — Near view of oyster shells on the gravel bar in Herring River. The set is about three months old. Notice the clean appearance of the shells.

Fig. 66. — Oyster seed, mostly two-year olds, attached to the wooden piles and the stones beneath Chequesset Inn wharf, Wellfleet, Mass. The abundance of the natural set on such objects indicates that successful spat collecting can be carried on in this locality. During severe winters the mortality is heavy, owing to the exposure between the tide lines; but these oysters have weathered two ordinary winters.

Fig. 67. — Oyster spat, one month old, on the shells of the experimental spat collectors located in Wellfleet Bay, 1908. Various shells, such as oyster, scallop, razor clam, clam, quahaug, silver or jingle shells can be utilized for spat collecting.

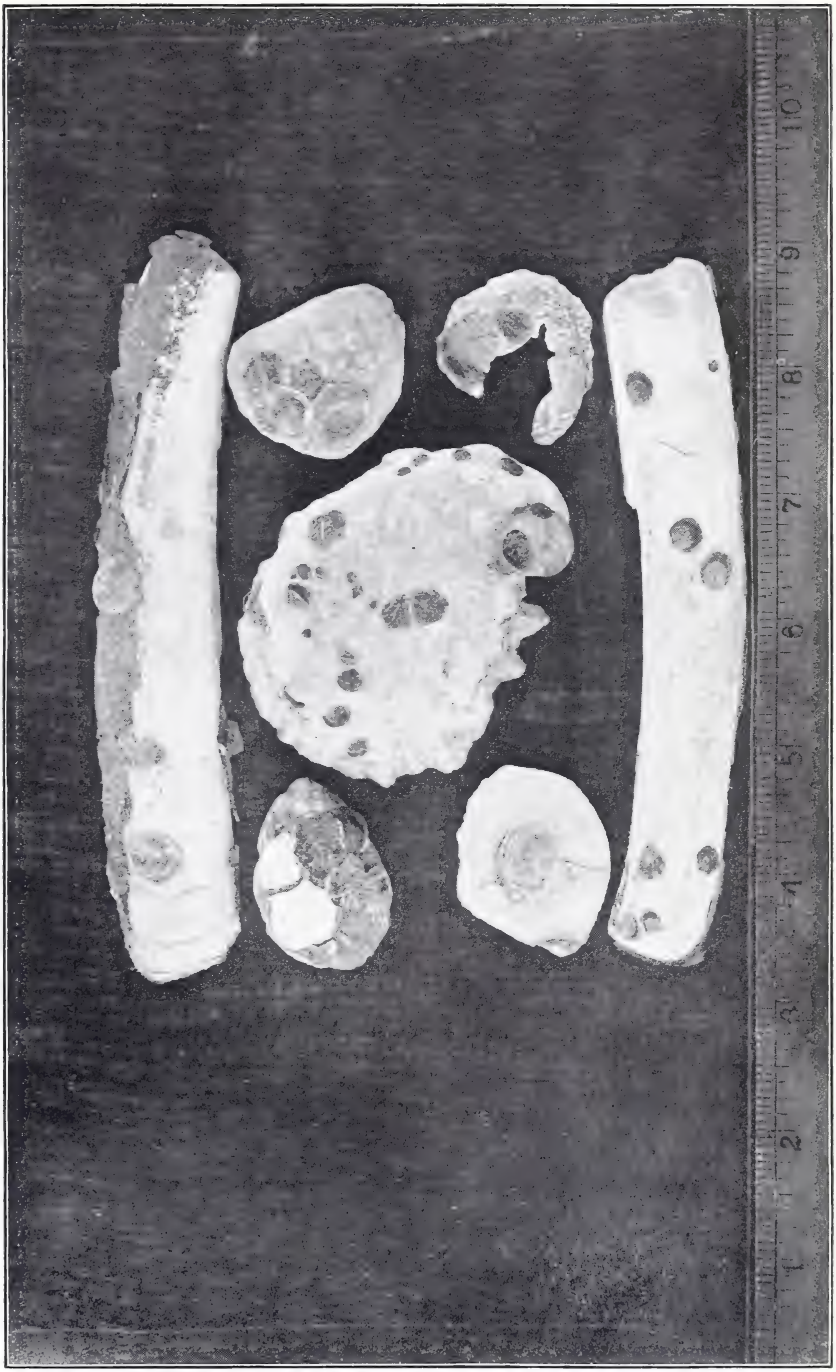


Fig. 68. — Figs. 1–20 illustrate the growth of the seed oysters caught on small stones. Figs. 1–10 show three-month-old oysters attached to living snails (*Littorina littorea*). Figs. 11–14 show the oysters of the same age attached to small stones. Figs. 15–18 show oysters one and one-half years old attached to small pebbles, while Figs. 19 and 20 show two and one-quarter-year-old oysters attached in the same fashion. Fig. 16 gives a peculiar illustration of the method of attachment. The young oyster has formed an attachment to a second pebble towards its free end at some distance from the first, indicating that the mantle, even at the age of one year, retains the power of secreting a fixative.

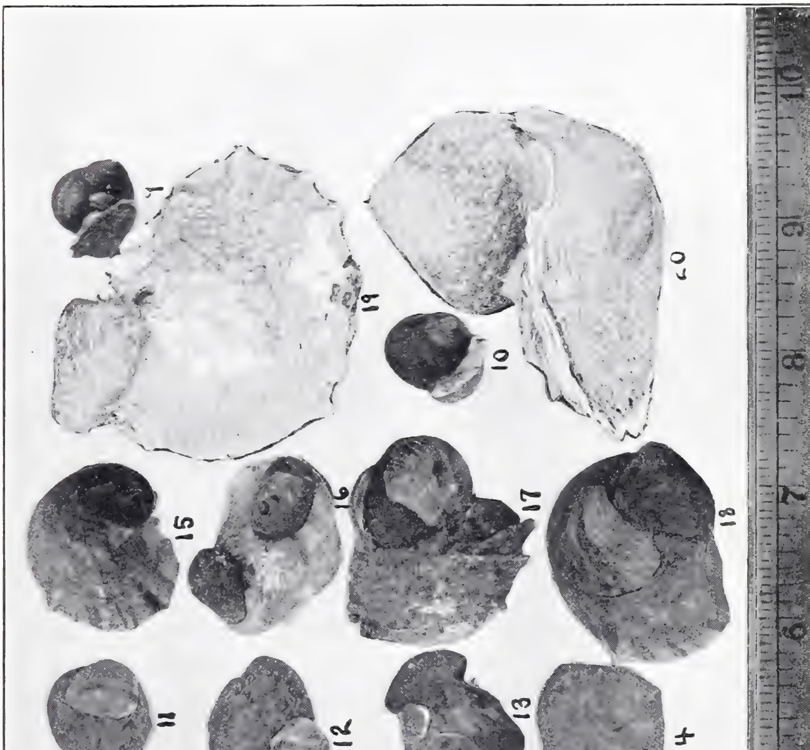


Fig. 69. — Three-month-old spat upon stones, which were gathered beneath Chequesset Inn wharf, Wellfleet.

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REPORT

OF THE

COMMISSIONERS

ON

Fisheries and Game

FOR THE

Year ending December 31, 1911.

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CONTENTS.

The Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-sixth annual report.

General Considerations.

In such a densely populated State as Massachusetts, great variation in quantities of game in various localities is to be expected. In general, where there has been an increase of game, the following factors have been at work. The arrangement of these factors in order of their contribution to the general good results is a matter of opinion and of locality. Doubtless in the first rank are (1) the system of licensing hunters, making possible (2) a more definite system in the enforcement of the game laws; (3) an increased area of game preserves, of State and private reservations, places which are specially protected and where abundant natural food is provided throughout the year; (4) increased propagation of game birds. The other contributing factors, in a varying degree, are the increased number of farms where grain is raised; the growth of covers after destructive deforestation; better control of forest fires; the awakening of the public to the number of useful birds destroyed by cats, skunks and other vermin; increasing restraint by intelligent people of dogs running at large during the nesting season of game birds; more reasonable self-restraint in shooting (though there are still many who kill every bird possible); prohibition of the sale of certain species; completely close seasons on certain species of birds, notably the wood duck, piping plover, terns, gulls, etc.

The prohibition of shooting after January 1 has, without question, resulted in an increase in the number of black and wood ducks stopping to breed in this State. There is developing in this State a better understanding between the gunners and the owners of the soil. The educational element has contributed much to the protection of the insectivorous and song

birds. We are endeavoring to collect data for the purpose of determining the normal present and possible bird populations in definite areas, for the purpose of determining the number of birds which may be produced annually per acre; also to determine the average bag in Massachusetts per hunter per day, and especially to secure data upon the relative proportion of posted specially protected land required to maintain a reasonable supply of game. There are at present ninety-eight persons propagating pheasants and ducks in this State. This feature contributes in no small measure, both from the birds which escape and the wild birds which are tempted to stop in migration on account of the numbers of propagated birds.

The market for the sale of wild game in Boston is very much demoralized. Apparently the best sentiment, both among the dealers and others most competent to form a valuable opinion, seems to agree that a law absolutely preventing the sale of any species of wild birds would contribute enormously to the conservation and intelligent utilization of our natural supply of birds, and would rid the dealers of a vast amount of uncertainty and unfortunate conditions. Increased propagation, the bag limit and prohibition of the sale of wild game seem to be the features which will attract most attention at the coming session of the Legislature.

Considerable apprehension is felt lest the pheasant kill or drive away the native bobwhite and ruffed grouse. While it is certainly true that the cock pheasant is an exceedingly pugnacious bird during the mating season, this impulse is chiefly directed against his own species. This pugnacity is equally characteristic of the ruffed grouse.

In the other aspect of competition, viz., for food, the pheasant does not occupy the same covers with the grouse. Like the quail, the pheasant affects the open. Most of the unfavorable observations upon pheasants have been made upon specimens in confinement, obviously not a fair criterion. Here perverted conditions, *e.g.*, feather eating interpreted as proving habitual cannibalism, etc., is the result of confinement and unfavorable food.

Competent observations and testimony as to conditions in the Willamette valley, Ore., where the pheasant has been longest naturalized in this country, indicate that the pheasant has

in nowise diminished the normal population of ruffed grouse, bobwhite and other species of quail. Although the pheasant has, for nearly two thousand years been in competition with the native birds of Great Britain, there appears no evidence that its presence is prejudicial to the native birds, but rather that it is, above all other species, of paramount importance for food and sport.

While we still believe, as we have stated in previous annual reports, that our native birds should receive primary consideration, as a practical matter it is at present impossible to secure breeding stock which can be handled at reasonable cost and with certain results. The ring-necked pheasant combines all the desirable features in greater degree than any species at present available, — omnivorous, resistant to climate, valuable as human food. While doubtless injurious to crops, it is certainly less so than is domestic poultry at large, while the desirable qualities appear to more than offset the undesirable.

We have reared and distributed pheasants because of the ready availability of breeding stock, the facility with which the depleted sections can be populated, their great ability as insect destroyers and their importance as a table and game bird, as well as their æsthetic attraction to every nature lover.

Expenditures. — The details of all expenditures are published in the annual report of the Auditor of the Commonwealth. In general, $2,815.30 was expended for the benefit of the sea and shore fisheries; $12,124.10 for maintenance of inland resources, by the purchase and propagation of trout, quail, grouse and pheasants; $40,747.05 for the enforcement of the fish, game and bird laws on land and sea; $1,726.99 for the protection of adult female lobsters, by purchase of those caught when carrying eggs; $6,390.17 for the salaries of the commissioners, printing, postage, traveling expenses of the commissioners, and for clerical and office expenses; $875.19 for biological investigation of the ponds of the Commonwealth; and $135.30 for investigation and report on the lobster industry. The total amount of fines imposed was $3,829, of which $3,554 was paid during the fiscal year. In addition, the money received and turned into the treasury of the Commonwealth, directly through this department, was $46,691.07.

Spring Shooting. — Testimony as to the efficacy of the law

preventing shooting wild fowl after January 1 is accumulating, and there can be no question that this law is in largest measure responsible for the notable increase of wild fowl during the season from September 15 to December 31.

Propagation of Game. — Real progress has been made in the matter of game propagation and the marketing of game thus produced. Massachusetts has taken an advanced position in developing conditions which will make it possible for people controlling suitable territory to propagate game birds and quadrupeds in such a manner as to add to the family income and to increase the available supply. We believe the time is not far distant when every farm may propagate game birds with as much certainty and success as poultry is now propagated. In addition to the propagation of game birds and animals, the question of breeding fur-bearing animals is of prime importance; foxes, skunks, mink, beaver and otter are now being propagated in various parts of the United States, with a large degree of financial success. It is time to consider whether the killing of fur-bearing animals should not be regulated, for the purpose of making it possible to secure breeding stock, and to prevent indiscriminate slaughter of these valuable animals at times when their fur is of little or no value. The problem involves a conflict of interests between the fox hunter and trapper on one side, and the poultryman and farmer on the other; and the situation must be worked out with due consideration of all the interests involved.

A close season on fur-bearing animals is by no means novel, since Vermont, as far back as 1812, permitted muskrats to be taken only from March 15 to May 25. Since then, several other States have placed similar restrictions upon the destruction of fur-bearing animals. The licensing of trappers would tend to diminish unnecessary cruelty by regulating the practice, and, by eliminating irresponsible persons, tend to conserve an important economic asset.

Doubtless the most important advance of the year has been in connection with the development of reservations where wild life may find protection, food and favorable conditions for breeding. The measure which seems to promise most for the conservation of wild life is the prohibition of the sale of wild

game, and a tagging provision by which such species, when brought upon the market, are tagged in such a manner that the purchaser may know that the birds were not killed in violation of law, and that the purchaser incurs no liability for their possession. This would do much to eliminate the market hunter who now successfully evades the nonsale law on partridge, quail and woodcock on account of the inherent weakness of the law.

Heath Hen. — In a study of the biology of the heath hen it was found that hawks were a large factor in the destruction of the young, and, in some cases, of the adults. We learn that the marsh hawk, which in other sections of the country lives almost exclusively on mice, has on Marthas Vineyard developed a local race with a perverted appetite for birds.

Report of Contents of 26 Marsh Hawk Stomachs from Marthas Vineyard, by Dr. A. K. Fisher, in charge of Economic Investigation, United States Bureau of Biological Survey.

	1910.	
No. 1.	July 19.	1 song sparrow; 1 bobolink.
2.	July 17.	Head of chicken (fragments); foot of small bird.
3.	July 2.	1 bobolink; 1 Maryland yellowthroat.
4.	July 2.	Hair of rabbit; few feathers of song sparrow.
5.	July 2.	1 bobolink; 1 song sparrow (?); 1 goldfinch; hair of rabbit.
6.	July 2.	1 bobolink; 1 song sparrow.
7.	July 2.	1 song sparrow.
8.	July 2.	Hair of rabbit; 2 sparrows; 1 Virginia rail (?), fragments of jaw; 2 gizzards of other small birds.
9.	July 27.	1 field mouse (hair); 1 goldfinch (?), a few feathers; 1 sparrow, under mandible; 1 chewink (*pipilo*).
10.	July 27.	1 chewink (*pipilo*); 2 sparrows (song?).
11.	July 27.	2 chewinks; 1 rabbit.
12.	June 23.	Chicken (fragments).
13.	June 23.	2 chewinks (young).
14.	June 23.	1 young sparrow (song?).
15.	July 4.	1 young heath hen; 1 song sparrow.
16.	July 4.	1 small bird (warbler?).
17.	July 4.	1 field mouse.
18.	July 4.	1 field mouse; 1 shrew; 1 chewink.
19.	July 4.	1 savanna sparrow; hair of mouse.
20.	July 4.	1 rabbit; 1 chewink; 2 young sparrows (savanna?).
21.	July 4.	3 chewinks; 1 rabbit.
22.	Aug. 1–4.	1 rabbit; 1 savanna sparrow.
23.	Aug. –	1 Maryland yellowthroat.
24.	Aug. –	1 rabbit; 1 chewink; 1 garter snake.
25.	Aug. 9.	1 rabbit; 1 savanna sparrow.
26.	Aug. –	1 brown thrasher; 1 yellowthroat; 2 chewinks; 1 sparrow; 1 rabbit.

National Control of Migratory Birds and Fishes. — The introduction of several bills in Congress bearing upon various aspects of such a desirable federal law is an indication that, although a basis of legislation has not as yet been reached, strong tendencies are working in that direction, with a promise of ultimate success.

Breeding Places for Fish. — With the use of such destructive methods of fishing as beam trawling, torching, etc., it appears highly desirable to prevent fishing upon certain areas which are known to be natural breeding grounds of useful fishes. Such should be set apart, and specific regulations regarding the taking of fish should be established.

The Development of the Shore Fisheries. — In the marine fisheries the most important question which has arisen is in connection with the development of otter trawling, which is essentially an application of netting methods to parts of the ocean previously unexploited. This subject, an important one, is likely to arouse considerable interest.

The lobster fishery still continues in a deplorable state, and we again urge legislation which will check the destructive methods at present in vogue.

Mollusk Fisheries. — We note a development of public sentiment regarding the utilization of the area below high-water mark, both that uncovered by the tide and that in the deeper waters within the State jurisdiction, for producing food and bait mollusks. We believe the best possible method would be the leasing of a part or the whole by the State, thus securing stability in tenure, direct control by the people of the entire State, and the development of a business on a broad basis protected and supported by State officers. Massachusetts alone, of all the seacoast States, has done practically nothing to secure the development of these areas.

The present condition of the scallop fishery on the south side of Cape Cod has abundantly justified our protection and the enforcement of the law, even to the extent of temporary hardship to the fishermen. The fishermen now unite, under the influence of a vastly improved catch, to testify to the wisdom of our recommendations and the laws based upon them.

Activities outside the State. — At the annual meeting of the

American Fisheries Society at St. Louis, Mo., Oct. 3–5, 1911, Massachusetts was represented by your commissioners. Mr. Graham served on the publicity committee and Dr. Field upon the committee on resolutions. Of the resolutions passed the following are of special importance to Massachusetts interests. The first of these relates to fish and shellfish.

Whereas, Fish and shellfish of great value as human food, if placed in the hands of the ultimate consumer in good condition, are subject to rapid post-mortem chemical changes; and

Whereas, Much unnecessary uncertainty frequently checks the sale of such food; and

Whereas, This society deplores the lack of such accurate, sufficient and scientific data relative to such chemical changes, and the condition under which these occur, as is necessary to properly safeguard the interests of fishermen, dealers, distributors and consumers, and the public health; be it

Resolved, That this society urges upon Congress, upon the Bureau of Fisheries, upon the various States and upon all competent individuals, to enter upon an organized, unbiassed, detailed investigation of the problems connected with the chemical composition of the various fish foods, the progressive chemical changes and the toxic properties at various stages of decomposition, together with specific application of these facts to storage, distribution and sanitary utilization of these animals as human food.

The following resolution relates to reservation of spawning areas for fish: —

Whereas, It has been found necessary, for the successful maintenance of wild birds, to set aside national and State reservations as breeding places; and

Whereas, Competent biological observation in European countries, and more recently in Illinois, Indiana, New York, California and Massachusetts, has demonstrated that in order to maintain an adequate population of fish in our streams and coastal waters, suitable and extensive natural breeding grounds must be maintained by national, State and individual initiation and action; therefore be it

Resolved, That we urge upon the various States and upon Congress to take immediate action to acquire and to conserve such natural breeding grounds of fish, and to take appropriate measures for increasing their capacity.

The following resolution relates to the pollution of public waters: —

Whereas, In spite of the fact that many organizations of nation-wide influence have repeatedly urged attention to the enormous damage to public health and property by unnecessary and unwise methods of disposal of sewage and manufacturing wastes; and

Whereas, Many State Legislatures have enacted wise laws for mitigating these conditions, and for conserving the public health and the public resources thus imperiled, for preventing the wholesale destruction of fish life, the restriction of areas naturally suitable for breeding places, and the ultimate utter ruin of the potential capacity of these waters for producing food for fish and fish for food; and

Whereas, It is notorious that in many sections of the United States the facile introduction of sewage and manufacturing waste into streams and coastal waters has hitherto checked the development of advanced methods of economic utilization of these wastes, be it

Resolved, That this society urges upon Congress, upon the legislative and executive departments of every State and upon all good citizens, to thoughtfully act for checking the incalculably enormous wastes of nitrogenous material and of water, which, properly treated and distributed, would be most valuable upon farming land, and of many waste products of manufacturing which could at present and in the future be made of economic value.

The Massachusetts delegation to the Third National Conservation Congress (at Kansas City, Mo.), Sept. 25–28, 1911, organized as follows: chairman, G. W. Field of Sharon; vice-president, F. W. Rane of Boston; member of resolutions committee, William P. Wharton of Groton; secretary, F. F. Moon of Amherst.

Mr. Wharton secured the passage of the resolution relative to the conservation of wild life and to the pollution of streams and coastal waters. Mr. Rane addressed the General Congress on Conservation upon the "Economic Conservation of the Forests."

George W. Field, as a delegate from Massachusetts, representing the Commission on Fisheries and Game spoke as follows upon the "Conservation of Game Birds, Streams and Coastal Waters."

The problem of maintenance of the fish and the game in Massachusetts has developed rapidly, and within the past two years widespread interest has awakened for maintaining and increasing these natural resources. In addition to the usual restrictive laws which have been found more or less effective in various States, in Massachusetts special

effort is devoted to augmenting the supply, particularly by means of reservations selected for the special purpose of providing suitable breeding grounds and feeding places for a large bird population. The State is now divided into districts, each district being in charge of a paid warden, whose duty it is to become familiar with the details of the interrelations of the bird, fish and human population. This permits a more definite system of enforcing the game laws, develops an increased area of State and private game preserves for the propagation of game and insectivorous birds, better control of forest fires, more reasonable restraint in shooting, and important educative influence among the sportsmen and general population. The rapid increase of insect pests in the sections of the country longest inhabited indicates the necessity of a more augmented bird population. The English sparrow and the house cat have been responsible for much of the decrease of bird life. Modern forestry methods, demand for firewood and recognition of the danger of forest fires, thus leading to the removal of dead standing trees, has restricted the breeding places of woodpeckers, wrens, bluebirds, tree swallows and other insect-eating birds, so that definite and far-reaching methods of providing artificial nesting sites for these birds is absolutely essential if we are to maintain these useful birds. Deforestation, forest fires, feral cats and self-hunting dogs have been responsible for great destruction of the young of the grouse, quail and woodcock, and other ground-nesting birds. Drainage of bogs has destroyed the nesting sites of ducks and geese. Existing conditions can only be met by special attempts to duplicate natural conditions on less expensive land. Favorable feeding and nesting refuges, where shooting and even all intrusion is prohibited, must be maintained in numbers along the lines of travel of the migratory birds. These paths of migration are now well known for most of the important birds, from the northern breeding ground to the points of winter sojourn, from New England southwards. By the co-operation of all the States and of the national government, a very satisfactory series of bird reservations can be developed and maintained, under conditions which will be just to all classes of the population. The evils resulting from market hunting can be met only by absolute prohibition of the sale of wild game, while at the same time ample provision should be made for the encouragement of artificial propagation and the protection of those species which are of special value for food and as insect destroyers.

As president of the National Association of Shellfish Commissioners he spoke as follows: —

Massachusetts is actively taking up the question of utilizing the area below low-water mark for the purpose of cultivating clams, quahaugs, scallops, oysters and other food and bait mollusks. The rights of the

riparian owner extend to low-water mark, but the State reserved as easement the rights of fishing, fowling and boating, which, under the Body of Liberties, enacted in 1641, are free to every inhabitant of the Commonwealth. Under this system, unfortunately no one has found it expedient to cultivate any of these mollusks, except oysters, for the reason that the right to take the mollusks when marketable rested not in the owner of the land but in the general public. On this account flagrant abuses of these public fisheries have arisen; wide areas have been entirely depleted. The young mollusks, before they reached marketable size, have been destroyed in the mad rush to secure something "before the other fellow did." Our experiments and observations indicate that a person farming such ground under water may expect to net from $200 to $600 per acre, without employment of capital for plowing, fertilizers, etc. The crop is as certain as that of corn or wheat. Inasmuch as the present laws permit the cultivation of oysters and quahaugs, but do not permit the cultivation of clams and scallops, the situation is as absurd as if the State said to the farmer, "You may legally raise corn and wheat, but if you raise potatoes and barley, any citizen of the State may come in and appropriate the crop which you have planted." The value of the seashore area is little appreciated. As a matter of fact, this is, of course, the only region on which the well-known and much-appreciated types of sea food can be produced, and, as such, is a unique asset, and cannot be duplicated at inland shore resorts. It is subject to all manner of economic abuse. The streams and the seacoast are regarded as the natural sewers and dumping places for the débris of civilization. Of these, the most conspicuous in New England, perhaps, are the cities of Boston and New Bedford, where the discharge of sewage, manufactory wastes and other material has resulted in an economic loss in destruction of edible fish and mollusks alone of upwards of $500,000 annually, in addition to the cost of construction of the sewers and other apparatus of disposal, and the waste of nitrogenous material and water, valuable for irrigating the farming land. All these abuses have grown under the system of town control, previous to State supervision. The numerous and exceedingly profitable opportunities for cultivation of food and bait mollusks are idle, because labor and capital have not sufficient confidence in the system of town control of the fisheries.

At the sectional meeting of scientists interested in conservation problems, Dr. Field also spoke upon the "Relative Population of Birds in Different Countries, and the Influence upon Vegetation and Human Economic Interests."

Pollution. — The following letter has been sent to eighty-eight concerns and individuals who are polluting the public waters to a greater or less extent. Many of these have agreed

to withdraw the unnecessary pollution, and have either completed the work or are actively engaged in doing so.

BOSTON, MASS., ______________, 1911.

DEAR SIR: — We have a report that you are in some degree responsible for the infraction of Acts of 1910, chapter 460, by discharging waste materials into the streams of the Commonwealth.

It is not our intention to place an unnecessary burden upon any manufacturing interest, but we expect to secure your active co-operation in making the condition of our public waters a credit rather than a disgrace to our State.

Our marine fisheries were the original foundation of Massachusetts enterprise and wealth, and now, with the allied industries dependent thereon, yield not less than $20,000,000 annually to our citizens. The continuance of this, our most important natural resource, is in a very considerable degree dependent upon the quantities of alewives, smelts, white perch, minnows and other fish coming to our streams to breed, and whose greatest value is as a food supply for our commercial fish, *e.g.*, mackerel, bluefish, pollock. These fish come to our coast to feed on these small herring, smelts and minnows, which are also a source of bait for our fisheries industries. The progressive pollution has greatly diminished the productive capacity of our streams. The effects must become even greater, and must be followed by the ultimate extermination of such fresh-water fish as trout, black bass, pike perch and other valuable species, unless this wasteful practice is speedily abated.

We are actively enforcing the law relative to pollution, which went into effect Jan. 1, 1911, a copy of which is enclosed herewith. We trust, however, that you will co-operate with the State officials in ameliorating the conditions, and that we may hear from you as soon as convenient.

Yours very truly,

G. W. FIELD,

Chairman.

MONEYS RECEIVED BY THE COMMISSIONERS ON FISHERIES AND GAME FROM VARIOUS SOURCES DURING THE FISCAL YEAR 1911.

103 nonresident hunters' licenses, at $10,	$1,030 00
93 nonresident hunters' licenses, at $1,	93 00
43,947 resident hunters' licenses, at $1,	43,947 00
69 alien hunters' licenses, at $15,	1,035 00
Sale of egg-bearing lobsters to United States Bureau of Fisheries stations,	568 01
Forfeiture (one ferret),	2 50
Interest on deposits in National Shawmut Bank, Boston,	15 56
Receipts for fiscal year,	$46,691 07

There have been no applications for the inspection of fish under the Acts of 1902, chapter 138, and no fees have been received.

Distribution of Fish and Birds during the Year 1911.

Trout fry distributed,	696,000
Trout fingerlings distributed,	153,000
Adult trout planted in various streams,	787
Total output of fish,	849,787
Number of pheasants liberated,	613

Marine Fisheries.

The most promising development of the Boston market is the progress of the work on the new fish market near the Commonwealth Piers at South Boston. We believe that the dealers behind this project will realize the enormous importance of every well-advised effort which makes for increasing the confidence of the people in fish as a source of healthful food. We believe that the sanitary and even the æsthetic precautions which will be taken here in marketing the fish will increase the Boston fish trade many fold. The community is to be most sincerely congratulated upon the enterprise and the wise foresight of the leaders in the fish business of Massachusetts.

The reader is referred to the most excellent reports of the Boston Fish Bureau, which gives, in far greater detail than we are able, facts and comparative statistics in regard to the marketing of fish.

The visitor to T wharf cannot fail to be impressed with the rapid development of the fleet of motor boats which fish off the entrance to the harbor. The fishermen in this "kicker fleet" earn from $3 to $8 a day on an average, and frequently run up to $15 or more. The fish reach the market ordinarily in excellent condition. It is, however, an economic mistake to destroy the small herring, as is frequently done. A most effective protest should be made by the public against the catching of small mackerel. It is certainly a biological blunder to destroy enormous quantities of mackerel before they have had an

opportunity to breed, and particularly from the fact that the mackerel is a fish of exceeding rapid growth, and delay of a relatively short time before capture would increase the yield many fold.

The receipts of fresh fish at Boston direct from the fishing fleet showed a decrease from 1910.

Year.	Haddock.	Codfish.	Hake.	Cusk.	Pollock.	Halibut.	Totals.
1911, . .	46,444,800	21,173,000	10,488,125	2,771,700	6,726,840	900,850	85,065,315
1910, . .	44,791,820	25,903,060	16,399,700	2,359,300	10,149,200	629,888	100,232,968

Some of the best stocks were: —

Vessel.	Captain.	Gross Stock.
Mary C. Santos,	Manuel C. Santos,	$40,000
Elizabeth W. Nunan,	Frank Nunan,	39,110
Pontiac,	Enos Nickerson,	35,200
Washakie,	Charles Nickerson,	34,100
Gladys and Nellie,	Frank Watts,	33,200
Belbina P. Domingoes,	Manuel Domingoes,	32,000
W. M. Goodspeed,	George Perry,	30,000
Jeanette,	Frank Santos,	28,700
Richard Nunan,	Robert Wildes,	25,200

The season at Gloucester has been fairly satisfactory. Some of the best stocks for 1911 were: —

Seiners.	Captain.	Stock.
Schooner Monarch,	Captain Matheson,	$19,000
Schooner Clintonia,	Ralph Welber,	18,000
Schooner Arthur Jones,	Archie Desire,	14,000
Steamer Bessie Dugan,	John Vautier,	14,000
Schooner Ralph Hall,	Frank Hall,	13,000
Schooner Mary E. Harty,	Reuben Cameron,	13,400
Schooner Constellation,	Chas. Maguire,	12,000
Schooner Salodin,	Wallace Parsons,	11,000

The high-water mark in the salt cod fishing of the North Atlantic has apparently been reached; all records past and present have been completely cast in the shade by the magnificent performance of Capt. Clayton Morrissey in schooner "Arethusa," landing 839,716 pounds codfish, stocking $33,978; gross crew share, $668.22. Three trips were made: first, 215,000 pounds, $1,751.10 stock, $170.91 crew share; second, 261,686 pounds, $9,565.77 stock, $194.43 crew share; third, 362,170 pounds, $15,661.48 stock, $302.89 crew share.

Schooner "John Hays Hammond," commanded by Captains Lemuel E. Spinney and Fred Thompson, stocked $35,000 (net) halibuting.

Schooner "Premier," Capt. Wm. Morrissey, stocked $21,882 (gross).

Schooner "Tattler," Capt. Alden E. Geel, in her two trips (handlining) stocked $19,000.

Schooner "Mystery," Captain Mason, in a seventeen-day halibut trip stocked $5,100; crew share, $152.

Schooner "Fannie E. Prescott," Capt. William Forbes, stocked $9,389.68 on her dory handline trip, the high-liner of the crew sharing $250.

Schooner "Francis P. Mesquita," Capt. Joseph P. Mesquita, stocked $20,463.17 from March 1 to October 1; crew share, $659.50.

Schooner "Julietta," two night mackerel netting, stocked $1,650; crew of seven men sharing $164.

Schooner "Marguerite," Capt. Jacob P. Barrett, landed a swordfish which when cleaned for shipment weighed 631 pounds, and sold at 11½ cents, the largest seen hereabouts.

Schooner "George H. Lubee," Capt. Maurice Lubee, stocked $4,000 swordfishing.

Schooner "Elizabeth W. Nunan," Capt. Frank A. Nunan, from Sept. 8, 1910, to Sept. 8, 1911, stocked $39,110; crew share, $1,257; fish landed, 1,647,000 pounds.

Gloucester is annually augmenting her renown for manufactured fish. The number of specialties is constantly increasing, thus making for the development of the town and for the convenience and health of the consumer.

The development of new mechanical methods for taking fish

is in process. The number of steam gill-netters is increasing. A spirited discussion of the problems involved in steam trawling, as compared with fishing by sailing craft, is pending. This can only be satisfactorily settled by a more complete scientific investigation than has ever yet been undertaken by any institution or nation. With the increased destruction of mature fish it becomes exceedingly important to utilize every possible precaution and device known to science to prevent the destruction of fish eggs; to make it possible for these to be returned to the water in a manner most suitable for securing to them a living chance to reach maturity.

One of the most feasible opportunities for increasing the quantity of food fish available for man is to decrease the number of those predatory species which now subsist upon fish suitable for human food. Most conspicuous among these is the shark family, of which the dogfish occurs on our coast in enormous quantities. A report upon the dogfish question follows: —

Report upon the Utilization of the Dogfish.

There is great danger that the equilibrium of nature may be upset by unwise fishing practices, *e.g.*, confining commercial fisheries almost exclusively to certain species, viz., mackerel, cod, halibut, haddock, hake, pollock, etc., to the exclusion of other species which up to the present time have been considered to be "not worth marketing," namely, sharks, skates, rays, whiting, etc. On account of the vastness of the ocean, and of the exceedingly complex interdependent relations of the numerous species, the effects of human activities may remain long obscure. Nevertheless, the constantly increasing cost of living and the attendant extension of fishery methods must ultimately require that proper precautions be taken to secure wise exploitation of these vast resources, for the conservation of which nations as well as States and individuals must be responsible.

In common with the many species of fish sought as food, dogfish have shown conspicuous local fluctuations, which as yet often are difficult of explanation. At such periods of excessive abundance considerable damage has been done by the

dogfish to the fishing interests, thus indirectly affecting the general public. Largely through the initiative of Representative E. C. McIntire, the Massachusetts Legislature passed chapter 12, Resolves of 1905, under which your commissioners made certain investigations to ascertain the damage done by dogfish to the Massachusetts fisheries. The results are embodied in our fortieth annual report, for the year ending Dec. 31, 1905.

As summarized from the reports of interviews with 584 masters of fishing vessels, and of trap and weir crews (all except 3 reported damage to gear by dogfish), we found that the average total annual catch of edible and bait fish was 194,915,050 pounds. Similarly, the average total number of dogfish was found to be 27,668,150. The total annual damage to gear was $160,817.50, unquestionably a burdensome tax upon a calling already poorly paid in proportion to its hazardous nature. But even more serious is the fact that these figures cover only the actual loss due to damage done to fishing apparatus. To this must be added more than $250,000 for those edible fish taken on trawls and in nets which are so mutilated by dogfish as to be unmarketable, — in many instances the bodies having been completely eaten and the heads left on the hooks. While the observable damage to Massachusetts interests can be conservatively estimated at not less than $400,000 annually, the real cost of maintaining dogfish in excessive numbers is due to the fact that sharks in general, of which the dogfish is a typical and abundant example, eat incomputably vast quantities of commercially valuable fish. In fact, "every dogfish living to-day is being maintained at the public expense as an unprofitable boarder at nature's table, daily eating and destroying on an average not less than one to five pounds of commercially valuable food fish, worth at least, at a conservative figure, one cent per pound. Thus it may be properly inferred that the dogfish destroy more fish than are caught by the combined fishing fleets of the world. Public attention is awakening to the fact that many of our most valued sources of food are certainly becoming depleted, viz., lobster, bluefish, mackerel, etc., and that it is absolutely essential to assist nature in order to maintain the supply."

Man may assist nature in such cases either by directly pro-

tecting the adults in order that a larger number of eggs may be produced annually, or by artificially propagating the eggs and young, or by diminishing the numbers of the natural enemies. The former practice is already being carried out to some extent by the United States Bureau of Fisheries, but to secure quicker results this should be supplemented by the destruction of the natural enemies.

The Dominion government has already met the question of utilizing the dogfish as a source of oil and fertilizer. We have personally observed the methods in operation at Canso, N. S., Shippegan, N. B., and Clark's Harbor, N. S., as described on page 10 of our annual report for 1908, which reads as follows: —

These factories buy dogfish at $4 per ton and fish waste at $3 per ton, and turn them into oil and fish scrap, a small portion of which is sold to near-by farmers at $25 per ton, but the great bulk of oil and fertilizer is sold in the United States. The annual product varies from 100 to 300 tons of dried fish scrap, or sufficient to furnish nitrogen for 500 to 1,500 tons of complete commercial fertilizer. In addition to the benefits to agriculture by the production of fertilizer, the fisheries are relieved of a very considerable number of enemies, *i.e.,* each ton of dogfish scrap represents the destruction of approximately 37,000 dogfish.

The fertilizer thus obtained is of special importance as it contains a large quantity of nitrogen, the most costly of the chemical plant foods. A source of supply which at one and the same time furnishes a product essential to agriculture and relieves the fisheries of an enormous burden would be of very great economic importance.

The dogfish has become so destructive to our marine fisheries that some relief is necessary. Dogfish are not at present brought in commercial quantities to market, for the reason that no methods have been developed to make them commercially profitable. Gloucester and Boston, Mass., have the largest markets for salt and fresh fish in North America, and naturally there should exist facilities for caring for waste products, from which oil, glue and fertilizer can be made. The dogfish can be profitably handled, even if treated in the same class as fish waste, though it is valued as a food fish in many countries, and the dried fins are sold at a high price (25 cents per pound) in the Orient, where they are regarded as a special delicacy.

Inasmuch as the dogfish are migratory, therefore carrying their destructive operations to every fishing nation, the duty of controlling them is of national and international magnitude.

The first public recognition of the seriousness of the dogfish problem was obtained through the efforts of C. E. Davis, now of Portland, Me., then of Orr's Island, who secured the attention of the late Congressman C. Q. Tirrell of Massachusetts, who in 1904 introduced a bill in Congress which later was accorded a hearing by the committee on merchant marine and fisheries. This hearing was attended by Congressmen Tirrell, Gardner, McNary, Senator Lodge and by Dr. H. M. Smith, deputy United States Commissioner of Fisheries, Dr. A. C. True, director of experiment stations representing the agricultural interests of the United States, and State Senator H. A. Harding of Cape Cod, Representative E. C. McIntire of Gloucester and the chairman of the Commission on Fisheries and Game representing the Commonwealth of Massachusetts. While admitting the importance of the problem involved and the propriety of national consideration, the objections of the "bounty" principle were declared insurmountable. For securing the consideration of Congress, the following resolution was adopted by the Massachusetts Legislature, Feb. 21, 1907, through the initiative and efforts of Representative E. C. McIntire of Gloucester: —

Whereas, A species of shark commonly known as dogfish has become so numerous along our coasts that it is a menace directly to the fishing industry of our state, and through this indirectly to the public at large, both of the state and of the nation; and

Whereas, There is now pending before congress a bill which promises to bring some measure of relief from this enemy to the fisheries, and particularly the establishment of new industries based upon the destruction of the dogfish and other sharks and the conversion of these fish into fertilizer, oil, leather, and other valuable material; therefore be it

Resolved, That the general court of Massachusetts favors such legislation; and

Resolved, That copies of these resolutions, attested by the secretary of the Commonwealth, be sent to each of the senators and representatives from Massachusetts in Congress.

The chief objection to State and national action hitherto has been that a "bounty of some kind" has been the objective point. There is no gainsaying the fact that only rarely is "bounty legislation" effective. Numerous instances of bounties offered for scalps, heads, tails, etc., of mammals and birds have proved to be barren in real results and costly in administration. Thus, when through the efforts of Representative McIntire the Massachusetts Legislature, by Resolves of 1908, chapter 69, appropriated $10,000 for the purposes indicated in the following resolve, your commissioners undertook rather a study of the economic utilization of the dogfish products than any attempt at providing a bounty: —

Resolved, That the commissioners on fisheries and game be directed to make investigations and experiments with a view to lessening the damage done to the fishing industry on the coast of the commonwealth by dogfish. They shall first determine the most efficient methods of reducing the numbers of dogfish, or of capturing them in wholesale quantities, and second, determine and demonstrate the economic value of dogfish as a source of fertilizer, glue and oil, and the most suitable methods of utilizing them for such purposes; and they shall make such other inquiries, investigations and experiments as they may deem desirable for the purpose of keeping the dogfish in check, of providing a ready and profitable market for dogfish now incidentally caught, and of inducing fishermen to engage in the dogfish industry in order that a now worthless and destructive fish may be converted into an article of value. To carry out the provisions of this resolve there may be expended from the treasury of the commonwealth a sum not exceeding ten thousand dollars, and the commissioners are hereby authorized and directed to dispose, in such manner as they may deem proper, of any material or product obtained by them in pursuance of this resolve, and to pay into the treasury of the commonwealth the receipts from any sale of such material or product.

We are of the opinion, after careful consideration, that a State bounty for dogfish tails, or a per gallon subsidy upon dogfish oil, or a dogfish rendering plant conducted wholly or partially at State expense, would not be a complete or even satisfactory solution of the problem. It rather appears to be a proper function of the State to secure the necessary scientific data upon which private capital might in the future rear a

successful business enterprise, either separately or in conjunction with some existing plant.

It appeared that biological and chemical tests should be made which would furnish to some degree, in any event, information in answer to the manufacturers' question "what is there in the dogfish for me?" and also standardization tests by which the manufacturers could gauge the efficiency of their processes. We have therefore sought to point out all the important constituent substances which may be of commercial value in the dogfish carcass, to indicate its chemical constituents, and to determine the present market value of the various substances. For the benefit of the manufacturers the results are given in terms of percentage, while to make these figures mean more to the fishermen the commercial value of an average dogfish has been determined.

Value as Human Food. — In other countries, more densely populated, the food requirements have led to utilization of dogfish as human food. In this country, however, a foolish prejudice against this food is deeply seated. Although the dogfish appears to be an entirely clean feeder, and the flesh is as nutritious as salmon, halibut or any of our best market species, it is at present hopelessly out of style. The time is, however, not far distant when it will be utilized and added to the list of marketable food fish, as has, for example, the swordfish. The United States Bureau of Fisheries, through Prof. I. A. Field, has well set forth the food value of the dogfish in the Bulletin of the Bureau of Fisheries, Vol. XXVIII., 1908.

Value as Fertilizer. — At present, practically all the fish scrap used for furnishing nitrogen and phosphoric acid for farm and garden crops is derived from fish wastes, or incidentally, from the preparation of fish for market, or from conversion of the entire bodies of such species as may be taken in large quantities at relatively slight expense. No consideration whatever has been given to the question whether it would not be preferable to utilize for fertilizer those species, *e.g.*, sharks, which prey upon marketable species, and the destruction of which would therefore doubly or even triply benefit the people, (1) by reducing the number of predaceous enemies of the chief food fishes; (2) by lightening the destruction of such

species as herring, alewives, menhaden, etc., whose chief biologic value is to furnish food for mackerel, bluefish, squeteague (indeed, few people realize the importance of maintaining along our shores an unimpaired supply of young herring, alewives and menhaden, which attract large numbers of the larger fish and therefore insure the shore fisheries); and (3) by furnishing an additional source of nitrogen and of phosphoric acid, both of which are valuable and important for successful agricultural operations.

We are informed by Dr. A. C. True, director of the Office of Experiment Stations, United States Department of Agriculture, that "Fish fertilizer is of special importance as a source of nitrogen, the price of which is already high and is steadily rising as a result of a demand for nitrogenous fertilizer which is outrunning the supply. While fish fertilizer contains a considerable proportion of phosphoric acid, it is essentially a high-grade nitrogenous fertilizer. Any feasible means, therefore, of promoting the manufacture should be welcomed as adding to the sources of supply of the valuable fertilizing constituent nitrogen. Dogfish treated like the menhaden yields a fertilizer as rich in available nitrogen, though somewhat poorer in phosphoric acid. I have no doubt the product would find a ready market as a valuable addition to the fertilizer resources, not only of Massachusetts but of other portions of the United States."

In preparation of the fish scrap the extraction of the oil is a necessary incident, inasmuch as a residue of 12 to 15 per cent. of oil would retard the decomposition of the fish scrap in the soil, and thus impair seriously its agricultural value. In cases where the residual oil does not exceed 6 to 8 per cent., it is probable that its agricultural value would not be obviously impaired.

The establishment and operation by the reduction works at Canso, N. S., Shippegan, N. B., and Clark's Harbor, N. S., for the purpose of utilizing the dogfish was a highly commendable enterprise, and apparently the results have proved its wisdom. Analyses by F. T. Shutt of the Canada Experimental Farms of the samples of fish scrap from these sources show from 7.59 to 9.41 per cent. nitrogen and 2.94 to 6.49 per cent.

phosphoric acid. On account of the high percentage of oils (22.81 to 32.85 per cent.) it was found to be more profitable to extract the oil elsewhere by the naphtha process. Previously, Mr. Ellison of Cleveland, O., had found by experiment that 15,000 pounds of dogfish yielded as follows: the livers weighed 2,274 pounds, which furnished 1,010 pounds of oil, or about 44 per cent.; the bodies weighed 12,726 pounds, and furnished 605 pounds of oil, or less than 5 per cent., and 2,573 pounds of fish scrap, or about 20 per cent.

On page xvi of the forty-third annual report of the Department of Marine and Fisheries, Canada, the following description of the dogfish reduction works is given: —

The three works built by the department to test the feasibility of combating the dogfish nuisance, by converting them into commercial products, were operated during the season that the dogfish were on the coasts in any considerable numbers.

The Canso, N. S., plant began operations on September 14, and work was continued until the first week of December. During that time 999 tons, 1,875 pounds of raw dogfish were treated, which yielded 131 tons, 300 pounds of fish scrap, and 10,560 gallons of oil.

The works at Shippegan, N. B., were opened on July 3, and ceased operations on November 3. During that time 341 tons, 380 pounds of dogfish, as well as 785 tons, 882 pounds of fish offal, were treated, and produced 144 tons of fish scrap, as well as 2,000 gallons of oil.

The works at Clark's Harbor, N. S., were finished only last season, and so were operated for the first time. They are more complete in many ways than either of the others, not only having some improved machinery, but advantage was taken of the experience gained at the other works in arranging the plant. Operations were begun on September 15, and the works were closed for the season on November 16 following. During that time 245 tons of dogfish and 205 tons of fish offal were reduced, and 70 tons of fish scrap as well as 3,800 gallons of oil were produced.

In order to enable the farmers to avail themselves of the very valuable fertilizer that the fish scrap has proved itself to be, it has been sold to them, in such quantities as they might require, at the very moderate rate of $20 per ton f.o.b. reduction works, and, as its fertilizing qualities are becoming better known, the demand for it is increasing. Any amounts remaining after the farmers are supplied is sold to the best advantage, and brings usually a net price of from $27 to $30 per ton. The scrap is quite rich in nitrogen, containing as high as 11 per cent. thereof. The other valuable fertilizing product is phosphate, of which there is usually from 8 to 9 per cent.

The oil, as a usual thing, is readily salable, the ruling price obtained being about 28 cents per gallon.

It will be observed that nothing but dogfish were handled as a raw material at the Canso plant, the reason being that during the time the works were in operation dogfish were in such abundance as to tax the plant to its limit; but when such is not the case all available fish offal, as well as dogfish, is reduced.

Several unsuccessful attempts have been made to establish dogfish rendering works in the United States. Among those which attracted most attention was that of B. Frank Gallup, at East Boothbay, Me., who reconstructed the "porgie factory" formerly owned by Gallup & Holmes so that it was said to have the capacity of handling 1,000,000 dogfish per day. The price paid was $1 per 100. The conditions, such as the price paid the fishermen and the quantities of dogfish available, doubtless caused an early closing of the factory. A similar factory at Provincetown later proved unprofitable. Tests of material by the Russia Cement Company proved unsatisfactory under conditions there existing. Dogfish and other shark livers have been used in moderate quantity by various fish-oil manufacturers in Gloucester and Boston, but the quantities used have not been sufficient to keep the dogfish horde in subjection.

The obvious weak point in these enterprises lay in the incomplete utilization of the material. In no instances were the eggs separated for specific use; the preparation of high-grade oil from fresh-caught fish was not attempted; the fins and tails were not cured; no efforts were made to convert the flesh into "fish meal" for poultry or stock feed, or to utilize the skins. All these offer possibilities of more intensive utilization of dogfish. With these points in view the reports of Prof. A. H. Gill and Prof. S. C. Keith of the Massachusetts Institute of Technology, upon material furnished to them, are of value.

Professor Gill says, in part: —

Dogfish yield chiefly oil from the liver, and fish scrap; besides these they may yield oil from the body, and eggs. The fish in question is a variety of shark, and as the Chinese obtain gelatine from the shark fins and tail, it is possible that gelatine may also be gotten from these members in the case of the dogfish.

The average weight of the fish sent me was 8.8 pounds, of which the liver weighed 1.5 pounds. The liver contained 50 per cent. of oil, of which I obtained but 45, without extracting the scrap or press cake with naphtha, which, until the oil becomes more valuable, would probably not pay. Much of this scrap cooks up with the water used in rendering the livers, forming a "soup." This could perhaps be evaporated in a multiple-effect evaporator and used like "tankage." The total amount I obtained of fat-free scrap from a liver was only about 2 ounces; this contains 9 per cent. of nitrogen. The liver oil can be made of two qualities, and now is so commercially, — a very light yellow oil, amounting to 10 or 15 per cent. of the weight of livers used, and a dark brown oil. The light-colored oil I obtained by allowing the minced livers to stand over night in water, and skimming or running the oil from the top of the water; the dark brown oil by rendering at the boiling temperature and pressing the scrap. Possibly by the use of higher pressure than was available in my laboratory the yield of oil might be somewhat increased. The body without the liver contains 5 per cent. of oil, of which but 1 per cent., or 1½ ounces, is obtainable by rendering and pressing. Pressing would probably not pay.

To sum up the results of this investigation it would seem that an average dogfish will furnish the following: (1) ⅒ gallon oil, worth 2.75 cents; (2) 7.425 pounds fish scrap, worth 3.43 cents; (3) some gelatine.

Table showing the Products obtainable from an Average Dogfish weighing 8.8 Pounds.

Products.	Analysis.	Value in Cents.
7.3 pounds fish scrap from the body at $35.18[1] dry,	7.3 per cent. nitrogen, 2.4 per cent. phosphoric acid, 5 per cent. oil, 75 per cent. water,	3.21
⅛ pound scrap at $35.18, from the liver,	9 per cent. nitrogen, 5 per cent. oil, No water,	.22
.025 gallon light-colored oil at $0.32,	– – –	.80
.075 gallon brown oil at $0.26,	– – –	1.95
Total,	– – –	6.18

Skin. — The use of dogfish skin as a by-product is being seriously considered by certain companies. The rough surface

offers possibilities for the use of the skin as high-grade polishing paper, sword hilts, knife handles, purses, etc.

The investigation of the dogfish eggs was entrusted to Prof. S. C. Keith, Jr. His report follows: —

The purpose of this investigation was to determine whether the eggs of the dogfish had an economic value.

I am informed that dogfish abound in large numbers in the waters along the North Atlantic coast, and that the male and female fish exist in about equal numbers. The fish is viviparous, and in consequence catches of the fish not only yield the ovarian eggs, but also the young, to which are attached the yolk sac, which contains a larger or smaller amount of egg material, depending on the stage of development of the embryo.

The first fish brought in for examination, Nov. 11, 1909, were 9 in number, 6 being females. These fish yielded 3 to 8 ovarian eggs, besides several embryos with attached yolk sacs. From the 6 fish I secured 29 ovarian eggs, which had a total weight of 795 grams. The individual eggs varied in weight from 6.5 to 38 grams. The average weight was 27.4 grams, or a little less than 1 ounce, and each fish averaged to produce 4½ ounces of eggs.

On Aug. 9, 1910, I received about 20 pounds of the dogfish eggs. These were considerably smaller in size than others I had had. Twenty-seven eggs were found to weigh 500 grams, or approximately 24 eggs to the pound.

The egg substance is enclosed in a tough membrane that is broken with difficulty by pressure. When the membrane is ruptured the egg substance is readily removed by squeezing, and the yield is about nine-tenths the weight of the whole egg. The remaining tenth represents the weight of the membranes and adherent egg not easily removed.

The egg material is opaque and of a pale lemon-yellow color. Its consistency is similar to that of thick cream or heavy syrup, and the specific gravity is 1.046. The odor of the egg is a peculiar sickish sweet, and the taste, while distinctly fishy, is not unpleasant. The feel of the egg on the tongue is finely granular.

Some of this egg was scrambled, as an experiment to determine whether it would be available as a food product. The texture of the cooked egg was close and rather tough, and the flavor somewhat resembled cooked halibut. The result of this experiment did not encourage further investigation along these lines, although the egg unquestionably has a high food value.

A microscopical examination of the egg showed small fat droplets, of varying size and great numbers, of solid bodies 15 by 18μ to 20 by 30μ in size (about the size of potato starch grains). Many of these contained rectangular colorless crystals. Slight pressure on the cover

glass served to crush these bodies, and their appearance then was similar to crushed starch grains or crushed solid fat. Treatment of the egg with common salt changes the microscopic appearance very promptly. The bodies which formed the most conspicuous part of the microscopic field completely disappear and dissolve, and as a result the egg becomes translucent and very thick and viscous. From this action of salt on the bodies it is thought probable that their composition may be a nitrogenous compound of lecithin.

An analysis of the dogfish egg shows the following composition: —

	Per Cent.
Water,	41.70
Fat (16 hours ethyl ether extraction),	22.72
Fat (16 hours petroleum ether extraction),	22.84
Protein (N x 6.25),	29.82
Protein by difference,	34.06
Ash (salts),	1.40

For comparison, the following table is inserted, which gives the composition of the yolk of the hen's egg according to König. The average weight of the yolk of the hen's egg is 18 grams.

	Per Cent.
Water,	50.79
Fat,	31.75
Protein,	16.24
Salts,	1.09

It will be noted that the dogfish contains less water and fat and more protein than the yolk of the hen's egg.

The egg material is very easily separated from the membrane by slitting the membrane with a knife or some sharp instrument, and squeezing out the egg substance. As the eggs are of relatively large size this operation can be done quite rapidly. Attempts to crush the eggs in sieves were unsatisfactory, as the membranes so clogged the wire mesh that it hindered the egg substance from passing through readily. It has been suggested that the separation could be accomplished by passing the eggs through rolls that would break the membranes and squeeze the egg from them.

As it is manifestly impossible to secure and keep large quantities of dogfish egg in a fresh condition for a time sufficient for its extended use, some means of preservation becomes necessary. Common salt has proved to be the most desirable preservative for the egg for three reasons. First, it is cheap and effective. Second, the microscopic granular bodies in the egg are dissolved by it. Third, salt is one of the component parts of the alum tan liquors used by glove leather manufacturers, for which purpose the dogfish egg gives the most promise.

Dogfish egg to which 15 per cent. salt has been added keeps well at ordinary temperature without change, except that the portion immediately in contact with the air gradually changes to a brownish color. When salt is added to the pure egg, however, the consistency is changed from a fluid to a thick, solid paste, that can be blended with water only with great difficulty.

Experiments were made to overcome this fault, and it has been found that if the egg is properly diluted with water before the salt is added the resulting solution remains fluid, and, furthermore, does not discolor readily.

The best results were obtained by using 600 parts of the egg by weight to 250 parts of water and 150 parts of salt. The mixture should be stirred occasionally, until the salt is completely dissolved. A mixture made as above has been kept at the ordinary room temperature for a period of two months, without showing the slightest indication of putrefaction or discoloration. Incidentally, this mixture also contains practically the same percentage of fat as the commercial tanners' yolk, made from hens' eggs, so that the formulæ for the preparation of tan liquors do not have to be changed in any way when the dogfish egg is substituted for the yolk ordinarily used.

The practical tests of the dogfish egg in the tannery were made through the courtesy of the A. C. Lawrence Leather Company of Peabody. Samples of the prepared dogfish egg were used by them in tanning sample lots of several dozen skins, which, after marking, went through the routine treatment along with the regular stock. The only difference in handling was in the substitution of the dogfish egg for the hens' egg in the tan liquor. This kind of tannage is known as tawing or alum tannage, and is used very extensively in the manufacture of glove leather. The softened and dehaired hide, instead of being placed in a liquor of tan bark or chrome salts, as is done in making common leathers, is treated for several hours in a solution compound of alum, salt, flour, egg yolk and oil, after which it is dried, softened and finished. The white leather made with the use of the dogfish egg is soft and of about the same substance and feel as the regular stock, except that it is a little yellower in color, which would limit the use of the dogfish egg to colored leathers. On this account the market value of the dogfish egg would be somewhat less than the product from hens' eggs. The present market price for tanners' egg varies from 5 to 8 cents a pound, according to quality, and it is estimated that the dogfish egg prepared as I have recommended should be worth from 3 to 5 cents per pound.

Summary.

Total value of average adult dogfish: —

	Cents.
Scrap,	3.43
Oil,	2.75
Male,	6.18
Eggs,	.80
Female,	6.98

From the above investigations we are of the opinion that the total value of the products to be derived from a ton of dogfish would vary from $14 to $15, as follows: —

All males and immature dogfish,	$14 02
All females,	15 84
One-half males and one-half females,	14 93

This does not take into consideration any cash return for the skins and the peritoneum, and particularly for the fins and tail, all of which can be utilized under special conditions.

The fins and tails, slack salted and dried, are special delicacies to the Chinese, and there appears to be a favorable market demand now developing in this country. The dried fins and tails are said to retail for about 25 cents per pound.

Inland Fisheries.

New Hatcheries. — Negotiations are under way for acquiring a large and successful commercial hatchery for trout, and plans are developing for the establishment of a suitable hatchery for handling black bass, white perch, pickerel and other food fish.

It has been the privilege of your commissioners to begin an investigation of public waters of the Commonwealth in regard to their adaptability for the rearing of food and game fish. Massachusetts, from her geographical location, is favored not only with abundant facilities for the development of her marine fisheries, but also possesses many beautiful lakes, ponds and streams capable of producing, through proper stocking, an abundance of food and game fish. At the present time few of

the many thousand acres of inland waters are producing anywhere near their maximum possibilities. In the future, for the benefit of the public, both in the interest of sport and as one means of reducing the high cost of living, these latent assets of the State should be brought to their normal state of productivity. In the past these waters have suffered from overfishing, and many have been ruined by unnecessary pollution from manufacturing and other sources. With a view to improving the present condition of the public waters by the scientific handling and distribution of the important species of food and game fish, according to the conditions most suited to their existence, an investigation of the public waters has been undertaken, according to the Resolves of 1910, chapter 140, which reads as follows: —

Resolved, That the board of commissioners on fisheries and game is hereby directed to make a biological investigation and report upon the adaptability of the public waters of the commonwealth for rearing food fish. The board shall ascertain, as nearly as possible, the quantity and species of fish which various waters should be expected to produce annually, the best methods and species for stocking such waters, and the possibility of protecting the spawn or fry and of increasing the natural supply of food for fish so produced. For this investigation there shall be allowed and paid out of the treasury of the commonwealth a sum not exceeding two thousand dollars.

The report of the biologist of the commission, Mr. David L. Belding, follows: —

To the Commissioners on Fisheries and Game.

GENTLEMEN: — I herewith present a preliminary report upon the investigation of the public waters of the Commonwealth in regard to stocking with food fish, according to the Resolves of 1910, chapter 140.

A biological investigation of the public waters of Massachusetts in regard to the rearing of food fish will necessarily require a period of years for completion. The preliminary step in any work of this nature will naturally be to ascertain the present condition of these waters. In view of the numerous ponds, rivers and streams it will be at once apparent that only part can be examined at one time, obviously the most important. For these reasons the work of the past summer was confined chiefly to a biological survey of the ponds over twenty acres in area, such as the Commissioners on Fisheries and Game are permitted by law to stock with fish for the benefit of the public.

Massachusetts has within her borders approximately 850 ponds over twenty acres in area, of which some are used for water supplies by the various towns and cities. The latter were not examined, since in most instances fishing was prohibited by the local boards of health. Unfortunately, the ponds which were originally under twenty acres in size but had been raised by flowing could not be determined except by personal examination, necessitating considerable expense and loss of time. A total of 350 ponds were examined during the past summer, principally in the counties of Barnstable, Berkshire, Middlesex, Nantucket and Worcester.

Object. — The work during the past summer, in view of the future development in this extensive field, although of a preliminary nature, had under consideration the following ultimate objects: —

1. The general question of increasing the supply of food and game fish in the public waters of the Commonwealth.

2. A study of the food, growth, spawning and other habits of the different species of fish inhabiting these waters.

3. The determination of what species of fish are best adapted for certain classes of waters.

4. A biological survey of the ponds over twenty acres in area, for the purpose of obtaining (*a*) the species and quantity of fish, (*b*) the natural conditions which influence the life of the fish, and (*c*) a permanent record for future stocking.

The general plan of the investigation for the summer of 1911 was a preliminary survey of the great ponds of the Commonwealth, selected in preference to other waters by reason of their importance in the production of food fish. The survey was thus confined to ponds over twenty acres in area, since only ponds over this size are stocked with fish by this department. The work was divided into two parts: (1) an extensive biological survey of the ponds in regard to their general conditions, to form a guide for future stocking, thus making possible the placing of suitable fish in these waters. (As a result of this survey the ponds of the Commonwealth are classified into certain divisions or groups, according to the similarity of their natural conditions and species of fish.) (2) An intensive study of various type ponds, representing the groups above mentioned, throughout the year. For these types Gull Pond, Wellfleet; Sandy Pond, Lincoln; Walden Pond, Concord; Onota and Pontoosuc lakes, Pittsfield, by reason of their general characteristics, were selected.

Assistants. — Three assistants were provided by the department for the summer of 1911, and practically all their time was spent in the examination of ponds. Mr. William G. Vinal of Salem Normal School examined the ponds of Barnstable County from June 1 to September 8; Mr. Calvin B. Coulter conducted the survey in Worcester and Middlesex counties from June 1 to September 1; and Mr. Roy S. Corwin of Williams College in Berkshire County from July 1 to September 15.

Methods of Investigation.

Biological Survey. — The preliminary examination of the ponds in many cases proved difficult, owing to their inacessibility and lack of boating facilities. Each of the three assistants averaged about one and three-quarters ponds per day, the number of ponds surveyed in any given time depending upon their size and location. Only a superficial examination could be made in the limited time, the object being to obtain (1) a general knowledge of the ponds and waters of the State, and (2) a permanent record and guide for future stocking. The assistants were assigned to different parts of the State and supplied with the lists of ponds in their districts and printed blanks, on which the following points were to be written: —

(1) *Name.* — The list of ponds as printed by the State Board of Health in 1873 was used in connection with the geological survey maps. In many cases the names did not agree, and where this occurred the name on the map was considered as correct. Other local names were found, often the listed name being unknown in the immediate vicinity of the pond. In each instance all the available names were recorded. The names in themselves are interesting as illustrating their popular origin. For instance, on Cape Cod near the ocean are found many Herring Ponds, the name arising from the fact that the alewife or branch herring enters during the spring to spawn. Frequently ponds are named from their size, shape or general characteristics, *i.e.,* Long, Great, Shallow, Marsh, Muddy, Sandy, Six-mile, etc. Still other ponds are named after birds, as, *e.g.,* Swan, Duck, etc., or after the prevailing vegetation, as Lily or Cranberry. Among the artificial ponds the name of Mill Pond is of common occurrence. Another class has possessive names from the men or locality where they exist, while the most interesting still retain the old Indian names, such as Catacoonaung, Massapoag, Unkechewhalon, Chaubungagogigogmauchaugigogagungamaug, etc.

(2) *Location.* — The direction and distance from the nearest village, with ease or difficulty of access from the railroad station, and boating facilities were recorded, for use in the future shipment of fry.

(3) *Area.* — The areas of the ponds were taken from two sources: (*a*) the report of the State Board of Health in 1873, and (*b*) measurements from the geographical survey maps. No actual survey with instruments was made, and at best the given areas are inexact.

(4) *Depth.* — Soundings were made in such a manner that contour lines giving the depths could be charted on a map of the pond. In this manner the maximum and average depths could be ascertained.

(5) *Bottom.* — The sounding lead was so arranged that samples of the bottom could be obtained. Unfortunately, on hard or mossy bottoms no soil could be gathered by this method, and the nature of the bottom could only be estimated from the character of the shores or

in the shallow water. The following classes were distinguished: silt, soft mud, hard mud, fine sand, coarse sand, gravel, rock, clay, and grass.

(6) *Water.* — The color of the water was listed as either clear, green or brown, and the turbidity expressed in feet, the number representing the distance below the surface at which a white four-inch circular disc would disappear from view.

(7) *Temperatures.* — By means of a maximum and minimum thermometer the temperature could be taken at various depths in the different parts of the pond, to determine the presence of springs. In the deepest part a series of readings were taken at intervals of 5 or 2½ feet, to determine the thermocline, or point where the temperature drops rapidly. Deep ponds have three layers of water, — a surface layer, in which the temperature to a depth of 10 to 20 feet remains approximately that of the surface; a middle layer or thermocline, according to Dr. E. A. Birge of Wisconsin, in which there is a rapid fall; and a bottom layer of uniformly low temperature. The extent and nature of these three layers, which vary in different ponds and at different seasons of the year, are of importance as regards the life of the fish.

(8) *Shores.* — The shores around the pond were classified as woodland, the kinds of trees usually being noted; fields cultivated or uncultivated, such as pasture or meadow; and marsh land. The height and slope of the shores and character of the beach were recorded. Cottages, gunning stands, hotels, ice houses were located on a map, as indicative of the popularity of the pond as a pleasure resort.

(9) *Inlets and Outlets.* — The number of the inlets and outlets, the volume of water, temperature, amount of sediment and pollution in these were recorded in a general description. The presence of dams at the outlet showed whether the pond had been raised above its original area.

(10) *Animal and Plant Life.* — Notes were made of the animal life observed in the pond, and of the different species of aquatic plants in the pond and along the shores, while the plankton or floating microscopic forms were obtained by means of a tow net, as described under "Fish Food."

(11) *Fish.* — Information regarding the different species of fish inhabiting the pond was obtained from the fishermen or people in the immediate vicinity, who were acquainted with the pond. In the limited time at our disposal it was manifestly impossible to obtain this information in any other way, and for this reason the question of how good the fishing and what the present production of fish was only determined within wide limits and in a very general way.

(12) *Pollution.* — The existence of any manufacturing waste or unsanitary conditions affecting these waters was recorded for future reference.

(13) *Map.* — A sketch of the pond, showing the character of the shores, cottages, outlets and inlets, the soundings, temperatures and aquatic vegetation, accompanied each printed record.

Type Ponds.

Certain ponds, representing types of the various classes into which the ponds of Massachusetts may be divided, were studied more intensely. In these waters records of the temperatures, amount of food for the fish (the plankton organisms) and other changes were followed throughout the year. As illustrative of the three different types of deep ponds, Onota Lake, Pittsfield, Walden Pond, Concord, and Gull Pond, Wellfleet, were selected, while Sandy Pond, Lincoln, and Pontoosuc Lake, Pittsfield, were taken as the shallow varieties. The work on these ponds will serve as a basis for interpreting the results in the general survey of the other ponds in the State, which, as a rule, fall into one of these five classes. Thus a study has been made of deep and shallow, large and small ponds, both large deep and small deep, and of the different conditions for fish in these environments.

Fish Food.

A pond as defined by the dictionary is a body of fresh water usually less extensive than a lake. The word "pond" should, however, have a broader meaning. It includes all the organic life within its boundaries which goes to make it a complex whole, a perfect unit of animal and vegetable life. A pond can be likened, as it were, to a large organic molecule composed of many atoms, the different species which compose it, making the whole a perfect unit. But this huge molecule is never stable; it is constantly changing in the struggle for existence between the numerous species which inhabit its waters. We find, therefore, that whatever affects any species, no matter how small, changes the interrelation of the whole, particularly as affecting the food supply of the fish. The large fish prey upon the small, and the small in turn feed upon the minute floating animal and plant forms in the water. The amount of fish that a pond can support therefore depends directly upon the amount of small organisms in its waters, and a study of the fish food necessitates a study of the complex life in the pond as a whole.

The study of the fish food was taken up in two ways. (1) The examination of the stomachs of various species, both of the small and of the large fish, under certain definite conditions. (2) The determination of the amount of floating organisms in the different ponds in the State by means of a plankton net of silk bolting cloth. The work was placed upon a quantitative basis by making careful vertical hauls of the net from the bottom to the surface, and by knowing the amount of

water thus filtered and the species and quantity of the organisms, which were washed into a copper cup at the end of the net and then transferred to suitable preserving bottles for counting at the laboratory. By this means an approximate idea of the food value in the ponds of the State, as interpreted by consecutive work on the type pond throughout the year, could be obtained.

The work of examining the ponds will be continued along the same line during the coming summer of 1912, which will complete the preliminary survey.

Respectfully submitted,

DAVID L. BELDING,
Biologist.

The report of Arthur Merrill, superintendent of the Sutton hatchery, follows: —

To the Commissioners on Fisheries and Game.

GENTLEMEN: — I herewith submit a report on the fish-cultural work at the Sutton hatchery for the year ending Dec. 31, 1911.

The spawning for the present season furnished a total of 665,000 eggs, 180,000 from the brown trout and 485,000 from the brook trout, the latter producing a smaller number of eggs per fish than usual. Comparatively few eggs were collected from the yearling fish, owing to the small unselected reserve stock and to the loss of 1,000 of the best fish by a stoppage in the water supply when they were confined in the pens below the dam during the construction of an extension to the runway on the brook. In previous years the average size of the fish has steadily diminished, corresponding to the increasing number in the spawning pond. This year there was no increase in the number of brood fish, which was probably due to the lessened volume of water and the consequently higher temperature during the drought.

There were 672,000 brook and 157,000 brown trout eggs collected in 1910 and hatched the present year. Of the brown trout, 105,000 were liberated as fry, the remainder furnishing 21,000 fingerlings, of which 1,000 were reserved for breeders and 20,000 were put out for distribution. There were 250,000 brook trout eggs sent to the Adams hatchery, and these were replaced, in part, by 125,000 received from A. R. Graham & Son, Berkley. Of the brook trout, 348,000 were distributed as fry and the rest reserved for growth to fingerlings. Only 30,000 brook trout fingerlings were produced, which, with the 20,000 brown trout, made a total of 50,000. The brook trout fingerlings were all distributed except 1,000 selected fish, which were reserved for breeders. To these, 4,000 private hatchery stock were added, to make up the existing deficiency in brood fish.

The same conditions which impaired the quality of the eggs and fry during the previous year continued, owing to the drought. The scanty

supply of water for the hatchery resulted in poorly developed fry and heavy losses. The flow of water, while greater than during the preceding winter, when it was only one gallon per minute for 200,000 eggs, did not exceed one gallon per minute for 150,000 eggs. The losses were of the same character, but even more severe, viz., suffocation of the eggs and fry on the trays and in the early feeding period. The late fry were better than the early, although the reverse is usually true. The Berkley fry suffered as severely as the hatchery fry, which proved that the cause of the mortality occurred during the development of the embryo and was not due to the spawning conditions.

Improvements. — The work of improvement was carried on as usual. All the time not occupied in repairs and routine work was given to increasing the facilities for rearing fish and birds. The most important improvement was to remedy the above-mentioned defective water supply for the hatchery by replacing the old 2-inch iron piping with 4-inch pipe, which connected with the newer galvanized iron pipe running to the hatchery. This arrangement promised to carry an adequate supply of water, but at the end of the year the flow began to fall off. The trouble was partly remedied by taking up the lower end of the pipe near the hatchery and removing the rust, with the result that a sufficient flow was obtained to fill the hatchery faucets.

The concrete work was extended along the brook nearly to the dam, the new part consisting of slab work with covering pieces to hold the sides in place. The earlier work of this kind had been subjected for two years to severe freezing, with no apparent defects. Some concreting was done at the upper ponds in connection with fence building for the bird pens, and further extension should be made. The banks of the ponds should likewise be enclosed by concrete walls, to afford facilities for screening, — the most economical method of protection from predatory birds.

An excavation was made adjoining the upper end of the pond at the entrance of the brook and the pond water flowed back to prevent freezing, so that in the early spring a concrete runway for yearlings and a sectional channel to carry the surplus water could be constructed. This change will facilitate the handling of spawners and the holding of fingerlings from the ponds for shipping.

Early in the spring, owing to the drought and consequent danger from fire, a fire stop was made on the more exposed sides by removing brush and leaves. A start was made by stripping the loam for a permanent wood road along the south side, the most dangerous place. During the year a forest fire burned to the line on the north side, but was stopped at a plowed wood road, thus illustrating the efficiency of such fire stops.

The purchase of adjoining land increased the area from 10 to 23 acres. The new part was improved by clearing a space on the slope

of the hill for bird work, and by making a fire stop through the brush land on the north side for 1,800 feet. For some distance along this line posts were set for fencing. In view of the expected advent of the chestnut blight many chestnut trees were cut into posts or sawed into lumber. Only the chestnuts that by proximity affected the growth of other trees or were valueless for shade were used. Thus the other trees would improve in shape and present a better appearance than if the cutting had been deferred until the disease appeared. The cutting could be continued profitably, as the material is needed and many trees can be taken out to advantage.

Early in the year, during the winter months, the barn and hatchery coops were painted. Later in the season the house was reshingled and painted. The work on the grounds, besides the usual amount of planting and grading for permanent improvement, included the extensive planting of nursery trees, shrubs and plants for future use at the hatchery. Further planting is recommended to increase the stock of desirable varieties, especially trees suitable for pen and fencing material.

Recommendations. — The following recommendations for future work are made in view of the development of the hatchery: —

(1) A proper water supply for the house and grounds is needed, and could profitably be combined with a system for supplying many of the bird pens.

(2) Owing to the increasing work and equipment, a cook-house and storage shed are urgently needed.

(3) The fencing for the new land and road could best be deferred until proper material can be obtained and prepared by creosoting and painting. The native chestnut can be sawed on the ground to advantage, and will make permanent material which will not require any expenditure for repairs for many years. This stock is now being used for portable rearing pens and smaller wintering coops.

Respectfully submitted,

ARTHUR MERRILL,
Superintendent.

PROPAGATION AND PROTECTION OF BIRDS.

Massachusetts has from necessity been a pioneer in many important problems making for civic betterment and national progress relative to wild fish, birds and mammals. Like all pioneers we have made mistakes, which, as warnings, have ultimately been turned to good for other States as well as our own. The results from the introduction of the English sparrow, the gypsy and brown-tail moths, to mention only some of

the most prominent, is deplorable. Our failure to maintain within our borders some remnant of the wild turkey, or, as a State, to assist in saving the Labrador duck, the great auk and passenger pigeon, are only slightly mitigated by our recent belated efforts to maintain the last few individuals of the once numerous grouse, the heath hen, of which the only and last living specimens in the world are on a State bird reservation on Marthas Vineyard. Only recently have we extended any measure of well-deserved protection to the useful insectivorous birds (including the small hawks and owls), and to the migratory shore birds and sea fowl when returning to their northern breeding grounds or when, in stress of weather, they seek fresh water at the unfrozen spring holes. Our experience in Massachusetts conforms to that of communities all over the world. As a result we say to all, "Study and care for your native species of birds. Remember what the introduction of the English sparrow has done to our small, native, insect-eating birds." Is the introduction of the Chinese or English pheasant likely to bring similar disastrous results to our quail and ruffed grouse? Many bird students fear this. There is certainly a possible danger; but no one has yet brought out actual facts upon which a proper judicial opinion can be based. The chief danger lies in the possible introduction of infectious diseases. Of this we have some indications, though as yet insufficient evidence.

The facility with which these magnificent birds (*Phasianus torquatus* and *P. colchicus*) can be naturalized under most diverse climatic conditions, and the facility with which they become adapted to semidomestication, make them most attractive objects to bird lovers, both in the æsthetic and economic aspects. Next to the pheasant the bird at present attracting most attention in the United States is the Hungarian partridge. On account of the excessive price we have awaited the reports from other States, and have confined our attempts at artificial propagation to ring-necked pheasants (*P. torquatus*), quail (*Colinus virginianus*) and the ruffed grouse (*Bonasa umbellus*). Of the first, nothing need here be said. Experiences with both the quail and ruffed grouse, however, are sufficiently novel to

be interesting, and promising enough of ultimately successful results to warrant consideration.

It is not the place here to give details of our earlier methods and results. These may be found in our annual reports. Briefly stated, however, we find that small movable coops, wired with sufficient closeness to keep out cats' paws (not exceeding 1 inch mesh), high enough to prevent cats from reaching the birds, yet not high enough to permit the birds to dash themselves to death (3 to 4 feet high), and measuring from 6 to 12 feet on the sides, have proved more satisfactory, both as retaining and as breeding pens. Cleanliness and freedom from dampness are essential. A dry dust bath exposed to the sun and air, and a covered shelter completely open on southern wall, are also necessary in our latitude, as a protection against freezing sleet. A few evergreen branches so fastened as to furnish a screen are appreciated. Protection against rats, skunks and other digging vermin may be secured by nailing the edge of a 12-inch chicken wire of 1-inch mesh to the bottom of the coop, so that the width of the wire lies on the ground and at right angles to the wall of the coop. We find that one pair of birds to a coop gives best results. With occasional exceptions each female will make one or more nests in the coop, and deposit all or most of the eggs therein. A few individuals do not lay the eggs in the nest, but the great majority of the hen quails will continue to lay in nests even if the eggs are taken away and incubated under bantam hens, or in incubators. Whereas in nature a hen quail may be expected to lay from 20 to 30 eggs in a season, the average in confinement is much greater. For example, selecting from our 24 pens those which laid without accident through the season, we found that 20 such pens yielded a total of 1,156 eggs, the highest being 102, of which 100 were fertile, and the lowest 20, of which 14 were fertile, — an average of 58 eggs per pair for 20 pens. The total number of eggs laid was 1,447, of which 1,240 were fertile. Nineteen were broken in handling; 65 were destroyed in pens by field mice; 286 contained dead embryos; 50 died during hatching; 691 hatched normally, and 325 were reared to self-supporting age suitable for liberation.

In general, we have employed three methods of procedure

in hatching and rearing the young. In case the eggs are left to the quail we find that the chance of accident, *e.g.*, destruction of eggs by mice, death of one or both parents, is at a maximum. In several instances upon the death of a female the duties of incubation, and brooding and caring for the young, have been successfully assumed by the male. When the female is allowed to incubate the production of eggs is restricted. When the eggs are hatched under bantam hens, the female quails are permitted to produce more eggs, but some of the quail eggs are broken by bantams, and the clumsy, bustling, scratching foster mother sacrifices many of the tiny young in her misdirected activities. On the other hand, when incubators are used for hatching more chicks fail to escape from the shell, — a condition which can be reduced to a minimum by more careful attention to essential details, such as temperature and humidity of the air in the incubator. The great advantage of the use of incubators followed by use of brooders is in the control of infectious diseases. Each of these methods has advantages which various conditions may make dominant.

We are not yet certain which of the three methods is preferable. The personal equation in the attendant may be the dominant factor of success for any one of the three under special circumstances.

That part of the report of Arthur Merrill, superintendent of the Sutton hatchery, relating to the propagation of birds, follows: —

To the Commissioners on Fisheries and Game.

Gentlemen: — I herewith submit a report upon the propagation of pheasants, quail and European or gray partridges at the Sutton hatchery for the year ending Dec. 31, 1911.

The work has been an extension of the efforts of previous years, and has been conducted along similar lines with even more satisfactory results. Experience has shown the hindrances to the successful propagation of game birds and how they can best be avoided. Expenditures for increased facilities for hatching and handling the birds has increased both quality and production. In all 2,121 pheasant chicks were hatched from 4,447 eggs, and 940 of these raised to the liberating size; 280 quail were obtained from 715 eggs; and 4 European or gray partridges (*Perdix cinerea*) were raised from 22 eggs.

Pheasants.

During the present year the brood stock of pheasants was largely increased, for the purpose of obtaining surplus eggs and chicks for distribution. The rearing capacity of the hatchery was also increased, by the use of additional coops and brooders, as far as space would permit. Owing to the increased number of birds the brooders and small coops in the hatchery grounds were mostly used, and the birds confined in these until ready for distribution. On account of the restricted quarters and the excess of young stock, which in many cases led to persistent egg eating, the yield was lighter than usual, averaging less than 50 eggs per bird. The quality of the eggs was good, except at the last, when the fertility became low, possibly due to the close confinement of the birds. The first broods suffered severely from the cold weather in early June, particularly some experimental lots under hens. The brooder chicks suffered less, but were inferior to later lots, when better weather permitted more outdoor life.

The chicks put under hens gave satisfactory and in some cases exceptionally fine results, a large number being allowed to run free until ready for distribution, at the age of six to ten weeks. It was noticed that the birds chose a limited range, preferring grass, weeds or low brush, and where these were abundant strayed but a few rods from their coops. Little trouble was experienced in mixing chicks of different ages, and the quail coops in the open ground were never molested. As in the brooders and coops, the greatest success was obtained with the smaller lots, the difference being so marked that it seemed advisable to have less than 100 running together. However, any desired number can be handled by keeping them in colonies a few rods apart.

The pheasants at the beginning of the breeding season numbered 104 hens and 30 cocks, and were kept in 30 breeding coops. At the end of the season they numbered 80 hens and 25 cocks. The losses were due chiefly to death from natural causes, feather eating and to escaping from the portable coops, which were on rough ground or covered with light netting. There were 4,447 eggs laid, and from these 2,121 chicks were hatched. The number raised for liberation or for breeding purposes was 940, of which 334, together with 18 old birds, were reserved for breeding purposes, and 606 young and 78 old were distributed. The number reserved will stock 70 breeding pens, and if conditions are favorable should produce over 12,000 eggs.

Enemies. — Early in the season crows and hawks were very persistent in their attacks, the former being so bold as to compel the removal of some lots from the brush. The actual loss was less serious than was the effect of restricting the range and forcing early penning. The number handled was not large enough to justify keeping the birds closely guarded, as is necessary to avoid such losses.

Distribution. — A new plan of distributing pheasants a few weeks old, with a hen to rear them, was undertaken in response to the many applicants who desired to raise the birds at the point of distribution, thus by feeding securing some protective control. The chicks were taken from the hatchery lots as soon as they were of a sufficient size to acquire the habit of returning to the hen, and no longer required the exacting care of the first few days.

Mongolian Pheasants. — A pair of full-blooded Mongolian pheasants, received in March, were bred to acquire a stock of full and mixed bloods. The cock was mated with three hens, quarter blood Mongolian, which had been raised the previous year from a half-blood Mongolian. From 139 eggs 70 birds were raised, 55 being from the first 75 eggs. The vigor of this cross was in marked contrast to the ring-necks, and the birds showed greater hardiness than the pure Mongolian. From the 30 eggs laid by the Mongolian hen 21 chicks were hatched. Of these, 15 were raised to the age of two to three months, showing a vigorous rapid growth. The Mongolian pheasant appears more adapted to pen life, more contented in confinement, is more easily tamed and has less of the nervous quickness that renders the ring-neck liable to self injury. These traits suggest that this species might be better for colonizing, but in all probability less suited for game purposes than the ring-neck, and it is recommended that its adaptability be thoroughly investigated before it is substituted for the ring-neck.

Disease of the Mongolian Pheasants. — One of the younger birds at the age of three months became sick and was isolated for treatment, but soon died. The second and third birds suffering from the same trouble recovered. Five birds of another lot developed the same disease, 1 dying, the other 4 recovering. A pathological examination of the dead birds showed all organs normal except the liver, which was nearly covered with lesions characteristic of the amœbic disease in quail. The sick birds showed extreme emaciation. The droppings of the birds at first were green and hard, but later in the disease a greenish-yellow diarrhœa was observed, which in the nonfatal cases became scanty and foamy as the birds grew better. No disease of this nature had previously been observed in pheasants, and it is only remotely similar to the amœbic disease in the quail. It is evident that the Mongolian pheasant does not possess the same degree of immunity to disease as the ring-neck or quail, but has more vitality than the grouse, which are extremely susceptible to this type of infection.

Experiments. — Experiments as to the best methods of rearing were carried on in order to formulate instructions for the applicants receiving the pheasant eggs or chicks. These observations, although not in such detail as was desired, were of considerable value in indicating how methods of rearing could be adapted to the needs of people with varying experience.

Many trials were made to determine the number which would give the best results when grown in confinement. The hot-water brooders

were tried first with 25 chicks each, giving a percentage of raised birds at the end of the first month of slightly less than 30; a second trial with 20 chicks gave a percentage of 60, and a third trial with 15 chicks, a percentage of 80. An improvement in the general condition of the birds corresponding to the increasing number saved continued even after the chicks had been removed from the brooder.

Tests were made with lots of various sizes under hens in small coops, the conditions being approximately the same as when raised by the applicants. It was found that the largest number doing well, 15 to 20, suffered loss later by the failure of the feeble ones to develop, so that their average growth was less than the liberated birds. With the trial lots varying from 5 to 12 the loss was slight, while the growth, particularly in the smaller lots, was equal to the best at liberty. As a result of a season's work it was concluded that the birds so grown lacked the stamina of field-grown birds, an observation that should be further investigated during the coming winter and breeding season.

Feeding Experiments. — Maggots proved of substantial value as food for the birds confined in the small coops, but were not needed by the birds raised in the field. A test was made with six brooder lots, three being fed with maggots, and three without. Not only were the lots fed with maggots more numerous, but they surpassed the others in size and vigor. A similar experiment with the birds raised in the field showed no difference between a flock of 100 birds fed with maggots and a similar number fed with other food. From this it was concluded that the variety of food, together with the exercise derived from a free life, is sufficient to develop the birds on a more restricted diet than when raised in brooders and coops. A limited amount of curds and custard, prepared pheasant food, and, later, cooked food containing meat, will serve for field birds; but for coop or brooder birds the addition of maggots is very desirable. In the latter case it is advisable to continue the use of maggots, together with the custard and curds, to a more advanced age.

This year the prepared food was somewhat altered, the use of raw meat being discontinued, owing to the difficulty of procuring it in suitable condition for use. Raw meat is a good food when it can be obtained in a fresh condition and at regular intervals. In place of the raw meat a cooked food was given. This contained 20 per cent. meat, 5 per cent. bone meal, 30 per cent. broken rice (of the grade supplied for poultry use), and 45 per cent. fine cracked corn, sufficient water being added to swell the grain. This mixture was thoroughly cooked by steaming in a boiler.

Custard was used extensively, but always in rotation with less rich food, and forming only a comparatively small part of the whole diet. It is of considerable value as a food if used when fresh. It is necessary to have it eaten at once, and what remains taken away. We mixed in the proportion of 1 quart of milk, 5 eggs and 6 ounces of shredded

bread crumbs or pheasant meal, these three ingredients proving most satisfactory. Sour milk was used as formerly, with the whey strained out, or mixed with shredded wheat, bread crumbs, pheasant meal or ground grain, which absorb the whey. Sour milk is of particular value in inducing the birds to accept a change of food, as with it they will eat many things which otherwise they would be reluctant to take.

Pens. — The pheasants have been bred in small covered enclosures, permanent pens or movable coops. If these are not frequently moved the ground becomes foul and bare of vegetation, and the birds develop destructive habits, such as feather eating, which leads to the death of many when closely confined, and to egg eating, which is a source of constant loss. It is obvious that with the large increase of brood stock these habits will become more dangerous and will necessitate constant watching to correct. It is recommended that future pens be of a type which will prevent these pernicious habits and meet the requirements for a liberal yield of fertile eggs. For this purpose the pens must be of sufficient size so that the birds cannot strip the vegetation. A variety of vegetation should be provided, such as grass for green food, shrubs and evergreens for concealment of nests and to provide seeds and berries for food, and trees to provide shade and fruit. These pens should cover approximately 2,000 square feet, and should be built with sides high enough to hold the birds with wings clipped. Since molting comes after the breeding season the birds can be retained in the pens as long as desired, and then can be removed to covered pens. An easy method of handling the birds would be to cover one corner of the pen, in order to retain the birds when there was any likelihood of their flying out.

A further consideration is the probability of improving the quality of the fertilized eggs by keeping the breeding birds under the best conditions. Our experience indicates that the eggs of pheasants in small pens are less fertile than those of the birds reared in fields or roomy pens, and that the fertility decreases the more restricted the quarters.

Distribution. — The distribution of pheasant eggs, under proper restrictions, to people who desire to rear the birds for liberation, will extend the work of colonization with only the moderate expense of keeping additional brood stock, and will serve an educational purpose in familiarizing people with the rearing of game birds. Success in raising pheasants will indicate the persons who can be entrusted with the more difficult work of raising quail and European partridges.

The practice of sending out pheasant chicks a few weeks old with a hen to care for them can be profitably extended to supplement the work of the hatchery, and to meet the desires of a larger number of applicants. This method has proved the most practical means of colonizing the pheasant, since the birds, unless molested, will return regularly to their accustomed feeding places, and if they winter in that

locality are reasonably sure to breed near by. This method should prove more advantageous than the present means of distributing the birds. When liberated in a strange environment, the pheasants are quite certain to wander until they find a satisfactory home, and in this way pass from the observation of persons who would like to care for them. It might be advisable to send a suitable coop, since there is danger in the unsuitable chicken coops in common use. It is recommended that parties applying for the birds sow grain or grow a dense tangle of weeds, the kind of cover which the pheasants seek in preference to brush or woods.

Quail.

The quail averaged but 22 eggs, partly owing to the presence of several wild birds that laid but a few scattering eggs, but more especially to a general decrease from last year. A slight loss was caused by squirrels stealing eggs, but many of these animals were trapped before the birds were put in breeding pens. The number of eggs laid was 715, of which 90 were infertile. In the hatching, 135 were broken, 165 having well-developed embryos failed to hatch, 45 died in hatching, being partly or wholly out of the shell, and 280 hatched normally. A considerable number of the chicks were deficient in vitality and lived only a few days.

As compared with the previous year less satisfactory results were obtained in carrying the brood stock of quail over winter, in getting the eggs and in hatching, but the vigor of the birds and freedom from disease showed a great improvement over any year, indicating that by proper care the infectious diseases and the difficulty of wintering, hitherto regarded as the most serious problems in quail work, could be avoided. The problem of greatest importance, uniformly successful hatching, as yet remains unsolved, the various remedial measures applying only to certain conditions.

Diseases. — The young quail reserved for breeders were depleted by the loss of several lots from the infectious Alabama quail disease, and later others from gout, both lots containing the oldest and strongest birds. The second lot occupied a large pen which afforded ample opportunity for exercise. When attacked by the gout the loss was sudden and complete, only 1 out of 8 surviving. At this time the other young quail were in sheltered coops, approximately 4 by 8 feet in size, which opened only to the south and southwest. Liberal quantities of chaff and weeds were provided to afford a variable and material diet in which to scratch. Only one lot suffered any considerable loss. Coccidial infection was reported in some of those sent to the Bureau of Animal Industry. Several of the lot survived the winter and gave good service in the breeding pens. Late in winter one bird died of gout and a tendency was noted in others, but a restricted diet of weed chaff or apples, all grain being taken away, proved a prophylactic

measure. The exceptions to successful wintering were the birds affected by the coccidial infection, birds hatched in September which did not develop strength for successful wintering, and some old birds that were indifferent to exercise and food.

Several specimens which were sent to Dr. Tyzzer of the Harvard Medical School revealed a parasitic worm in the crop and œsophagus. The following quotation is made from Dr. Tyzzer's report: "Throughout its entire length the œsophagus presents small pearly nodules of pin-head size, which are numerous and quite closely packed, and which are more apparent viewed from the outer surface. Sections of the œsophagus and crop of these birds showed large numbers of parasitic worms situated in the mucous glands and in and beneath the epithelium of the mucous membrane. The epithelium is greatly thickened, and there are in many places irregular growths down into the underlying tissue. The mucous glands have been transformed into large irregular nodules of squamous epithelium. Large numbers of worms are found in every section, and the burrows and cavities in the epithelium contain great numbers of the eggs of the parasite. These eggs are large and ellipsoidal in shape, with a blunt projection at the two extremities. The characteristics of the eggs as well as of the worms themselves lead me to conclude that it is a species of trichosome. A worm of this genus is supposed to produce a considerable mortality in young ducks. The species (*Trichosomum annulatum*) has been described in the œsophagial mucous membrane of fowls by Molin. From the extensive injury which it produces in the mucous membrane of the œsophagus and crop, it must undoubtedly have a marked influence on the health of these birds."

It has been found difficult to carry breeding quail through the succeeding winter, and the small measure of success under the most diverse conditions for wintering invites the conclusion that the effect of captive life on quail is so weakening that at the best only a moderate number can be carried through to the next season for breeding. This mortality seriously impairs the quality of the brood stock by lessening the number of two-year-old birds, presumably the best breeders. Frequent shifting of the birds to fresh ground benefits to some extent, but not enough to carry them through the period when snow and ice render the transfer impossible. It is suggested that the difficulty can be best overcome by giving the breeding birds their liberty on reservations at the end of the nesting season, and recapturing them for use the next season, or when they are in good physical condition. In 1910, it was the practice to shift them to fresh pens; but in 1909, when they were not shifted, the heaviest loss came before winter. In 1910, the early winter, with frost and snow, prevented any moving, with the result that the birds weakened rapidly, and suffered from parasites, gout and indigestion. It is difficult, however, to differentiate this loss from that caused by the trichosome worm and other parasites. The loss from

gout included, besides the lot of 8 mentioned, the lot of 4 wild birds that gave good results in breeding during the previous season. The birds when mated and put into breeding pens met with the usual loss, which is considered a result of their enfeebled condition in wintering. One pair developed an eye trouble soon after mating, resulting in blindness and death. It was the first case of the kind observed, and resembled roup, but was not thought to be the same.

Hatching. — Laying commenced three weeks later than the previous year, and was slow at the beginning, especially with the domestic stock. The early eggs from these birds were poorly fertilized, but the later were better, and hatched a more vigorous lot of chicks than the wild quail. The wild birds laid smaller eggs, which hatched inferior chicks, or failed to develop.

Coops. — The small movable coop, used for breeding the domestic stock, was tried for the wild birds, with such satisfactory results that it seems unnecessary to provide the large covered runs. The coops used were provided with a supply of dried weeds tied in loose bunches, so that they could give concealment and nesting places. These weeds also served to vary the diet of the birds, and induce exercise by furnishing seed that was eagerly scratched for and eaten.

The enclosed wintering pens, with roof, were tried for both wild and domestic stock with satisfactory results. As the coops were not moved, green food was supplied by putting in boxes of growing buckwheat.

Rearing. — For rearing the quail the use of an adjacent field was secured, and when they became old enough they were taken from the brooders and placed in coops similar to the brooder coops, partly enclosed with shelter box and covered with paroid paper. The coop preferred was 4 feet wide, 6 feet long and 2 feet high, with a 6-inch board on the ground, and an 18-inch wire above it. The wire covered one end, one side and a part of the other side. The rest of that side and the other end were covered with paper, forming a protection from the northerly winds and storms. The closed end had a 2 by 4 foot movable top of light boards covered with paroid paper, and capable of being lifted from either side, the paper serving as a hinge; the rest of the coop was covered with a 4 by 4 foot wire cover, inch mesh, and was hinged at the middle so that it would lift in 2 by 4 foot sections. An opening was cut in the closed end and a box 15 to 18 inches, with top protected by cloth, was attached. This box served as a dusting place, as a shelter in storms, as a refuge for the birds when alarmed, and to shut them in when the coop was moved. The coops were moved once a week, that time being sufficient for a flock as small as six to scratch the ground bare.

No infectious diseases appeared until December, and then only in a small lot which became infected by escaping and feeding on infected

ground. Practically all loss was due to accidents or digestive troubles, which destroyed 6 and 7 birds of lots of 13 and 10 respectively. The cause of the trouble with the first lot was possibly due to a too scanty supply of food, followed by a too liberal supply. In a few days the surviving birds reached their normal condition and grew to a vigorous maturity. The second lot suffered from an intestinal colic following a cold storm in September. During the same storm a number of pheasants and bantam chicks died with the same symptoms.

The birds varied in tameness when placed out in the field, some recognizing their attendants but being alarmed at strangers, others being greatly disturbed at the approach of any one. Contrary to past experience, which indicated that they became wilder when visited infrequently, they were soon reduced to uniform tameness through careful handling and feeding. The first appearance of cows in the field put them in a panic, but in a few days these animals passed unnoticed. This tameness was of great service when birds escaped, as they could be approached when feeding and picked up by hand or by nets. In no case of handling or transferring was the slightest injury done, or their confidence impaired. The tendency to panics in the night still remained, and in some pens, as shown by the appearance of the birds, they were disturbed in some unaccountable frights, but without serious injury.

Cows were the most serious disadvantage in working in this field. The covers of the coops were knocked off occasionally, permitting the quail to escape. The upsetting of the coops in this way and by storms permitted many to escape, and the lots were considerably mixed when recaptured, so that the pedigree of the birds could not be traced.

Fighting. — The only damage from getting the birds mixed was that strange birds were killed in many coops. Cases of quarrelsomeness, resulting in injury or death, had been noted occasionally in consequence of mismating, when the cock had killed the hen, or when the flock resented the advent of a stranger. No trouble had ever been experienced in breeding more than one pair in a pen. One fatality occurred in mating birds this way in 1911, one cock being killed by the other. No trouble occurred in 8 other pens where more than one pair was bred. Previously, quail had been happy in their family life when raised, but several exceptions were noted this year, and deaths occurred in three flocks. It has been found reasonably safe to mix two flocks of nearly equal size, the principal damage resulting when a small number, one to three, was put in with a larger number in the old coop. The present practice in mixing birds is to put them in a coop new to both flocks, and, if the flocks are unequal, to put in sufficient brush and weeds for safe concealment until the birds become acquainted.

Habits. — The home instinct is strong in quail, and if the flock is divided those at liberty will speedily seek to rejoin the birds in the pen. When a whole flock escapes they are more uncertain in their behavior,

and while they do not seek to re-enter their coop, they invariably search for their accustomed food about other coops, with the result that recapture is not a difficult matter. Once when the coops were upset by cows 17 escaped, and 16 were recaptured; at another time all but 4 out of 30 were retaken. When the wind upset the coops and allowed 25 to escape in the storm, all were captured. The only failure to retake an escaped flock was when one of 8 birds, five weeks old, was moved from a brooder to a field coop at night, and escaped the next morning. They left the vicinity, as they had too little of coop life to feel at home.

Late in the season a flock of 5 escaped, and fed for a few days about the duck pens, where they were recaptured. In a few days all were dead from the bacillary, or Alabama quail disease, the examination of the United States Bureau of Animal Industry revealing a profuse white diarrhœa and intestinal lesions. This was the only outbreak of infectious disease, and the degree of immunity was obtained by keeping them away from the old localities. Keeping them on a very restricted diet brought about a friendly attitude toward the persons who fed them. A varied diet and frequent moving resulted in keeping them free from the kidney trouble or bird gout that has always been a serious drawback in rearing quail in coops.

The wintering of the quail has been most successful in sheltered and partially closed coops, permitting the free use of dust, chaff and weed shelters. Their diet consisted of a mixture of grain, with grit, charcoal, bone and meat scrap, varied by what they could scratch out of the weeds and chaff, and frequently by apples. The grain was not given when it was desired that the birds use the other food. It has seemed desirable, however, to get them from the winter pens on the ground much earlier than is necessary to collect them in breeding lots. While this could not always be practiced in the past, the additional land purchased will make it possible to do so the coming year, while the wintering, if successful, will make a larger number of coops necessary.

Rearing requires further experimentation, and while the present method is probably the most satisfactory way to carry choice lots desired for breeders, possibly it may not be the best way to rear a large stock for distribution, chiefly because of the large equipment and labor.

Bantams v. Brooders. — An important part of the next season's work should consist in testing the possibilities of rearing quail with bantams, and it is urged that the newly purchased land, a plot of ten acres suitable for this work, should be devoted wholly to determining to what extent quail can be field grown. If this method is feasible they will not be subject to the losses experienced with coop-reared birds. Brooder quail must of necessity be reared in coops, as, when liberated, they soon get out of control, but where grown with bantams they can be depended upon to return to the hen until they are large enough to be sent away. At the present time where quail have been reared in coops, the advantage is mostly with the bantams, because the younger quail, up to the age of a month or more, thrive best under them, apparently

because there is less loss from digestive troubles, which are evidently induced by brooder life.

The most extensive losses from infectious diseases, presumably transmitted from poultry, have occurred in brooder lots, because of feebler powers of resistance. Where quail have been grown in both ways, with reasonable precautions against infection, circumstances have indicated that the infection was from the outside as much with the bantam-grown birds as with the others. In no way can the possibilities of work with bantams be demonstrated, as it was with brooders this year, except by extensive work on new ground. Birds reared in both ways have shown about the same tendency to gout, but, as all were coop grown, the conditions were practically equal. As gout is recognized to be due to the conditions of coop life, and the remedy is found by varying the diet and in inducing activity, field-grown birds would be less subject to it. The wintering qualities have seemed to be poorer in bantam-reared birds, but if due to the influence of the hen on their health, the result is too remote to be conclusive.

The following directions for hatching and rearing apply to both quail and pheasants, and are intended for applicants who may receive eggs or young birds. As indicated, the directions are general, and there is often a choice of methods. This choice is to be determined by the applicant according to local conditions.

Directions for Raising Quail and Pheasants.

The Breeding Pens. — Breeding pens for quail or pheasants can be made of any convenient size. Small pens, covering 50 to 150 square feet, are practical, but less so for pheasants than for quail, as a small pen which would keep green and afford nesting places for a pair of quail, in a brief time would be stripped by a trio of pheasants, which would then be likely to acquire egg or feather eating habits, as a result of close confinement in bare pens. For breeding quail movable pens, 8 to 12 feet, are recommended where the ground is sufficiently level for their use. Where it is not possible to build large runs of 500 to 1,000 square feet for pheasants, the 12-foot pens are serviceable, provided there is room to move them often. The pens should have one corner made tight with roofing paper, light boards or duck, for shade and shelter from storms. It is advisable for pheasants, and important for quail, to have a shelter coop or box attached, to serve as a refuge. This should be dry enough for dusting, and should have a cloth or padded top, to avoid injury to the birds when alarmed. These features in coops afford satisfactory wintering conditions for pheasants, but quail require some additional protection, so that they can have dry dust and chaff; and besides, a box for refuge should have shelters of coarse weeds, preferably ragweed before fully ripened. Quail will winter best in such coops if kept in flocks the size of natural coveys.

Neither tame nor wild quail can be kept long in any coop in a healthy condition if in a large flock.

Hatching. — For hatching, old bantams are preferred for quail, while young bantams or large hens will do well for pheasants. They should be kept in clean coops, made as tame as possible and become accustomed to handling. All possible precautions should be taken to keep them healthy, as any infectious or contagious disease, or any parasites, would be transmitted to the chicks. Coops should be kept free from vermin, especial care being taken to keep the laying nests free of mites, as they would be transferred to the hatching nests when the hen was set.

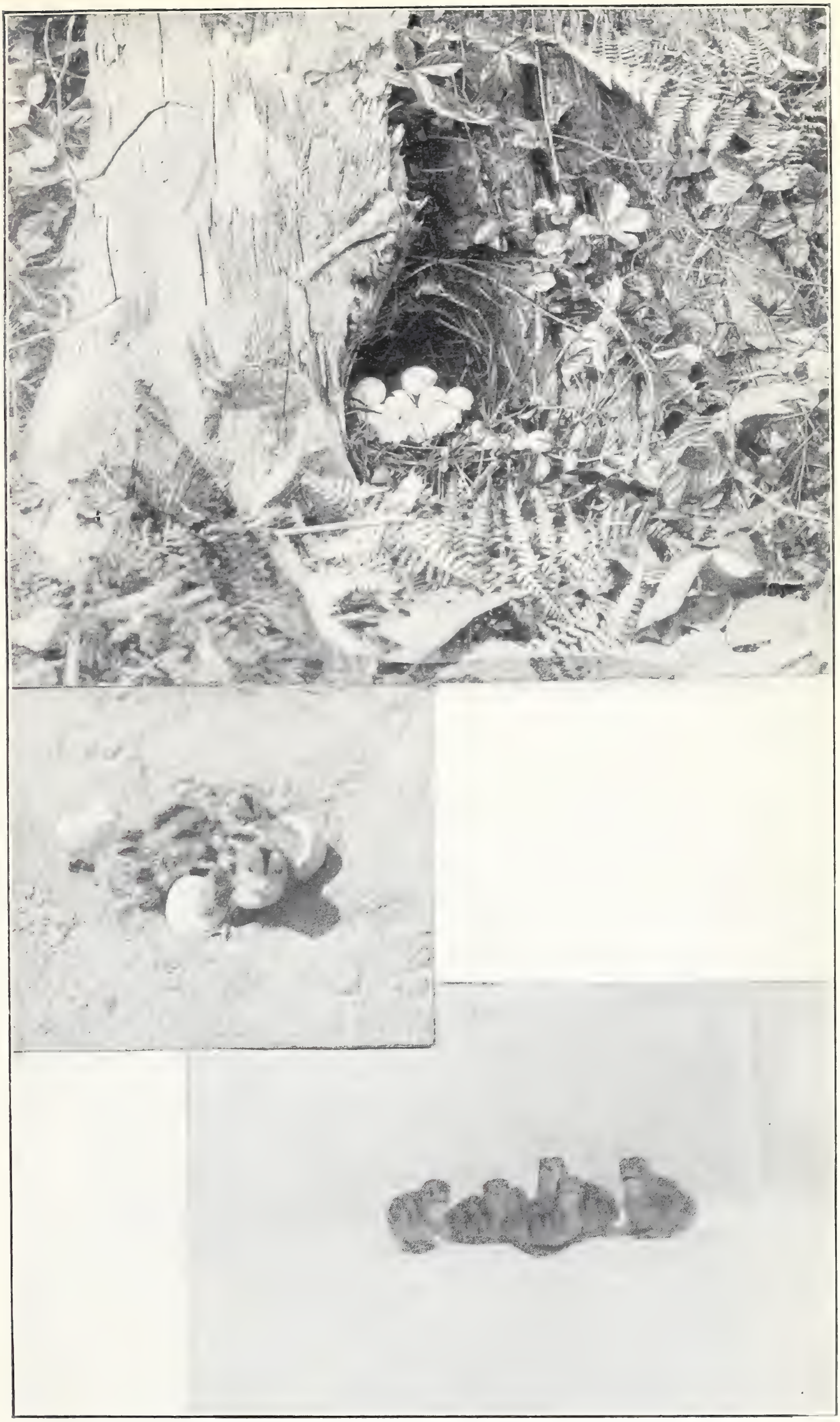
(*a*) *Nests.* — Setting nests should be placed in a shady place, under trees or in a cellar. If in a cellar the ventilation should be good. If neither place is available a shed will make a satisfactory hatching location. The number of setting hens should be more than required for the eggs set, so that, in case of failure of any fowl to set, her eggs can be transferred to the spare hen. If inspection is reasonably close, and eggs abandoned are promptly shifted to another hen, there need be only slight loss from this source, as the eggs will stand a great deal of cooling.

Nest boxes should be connected with the coops, so that the hens can be shut off for airing, cleaning the eggs or changing the nest. It is best to use nests without bottoms, but if rats are abundant wire bottoms should be used, with door for closing at night, and wire-covered ventilating holes. The nest can be made of loam, with a light lining of hay or straw, or a larger amount of straw in place of the loam. If space is limited, and it is necessary to confine the work to a cellar or shed, the use of a stack of nests, letting the hens out in one room, is recommended.

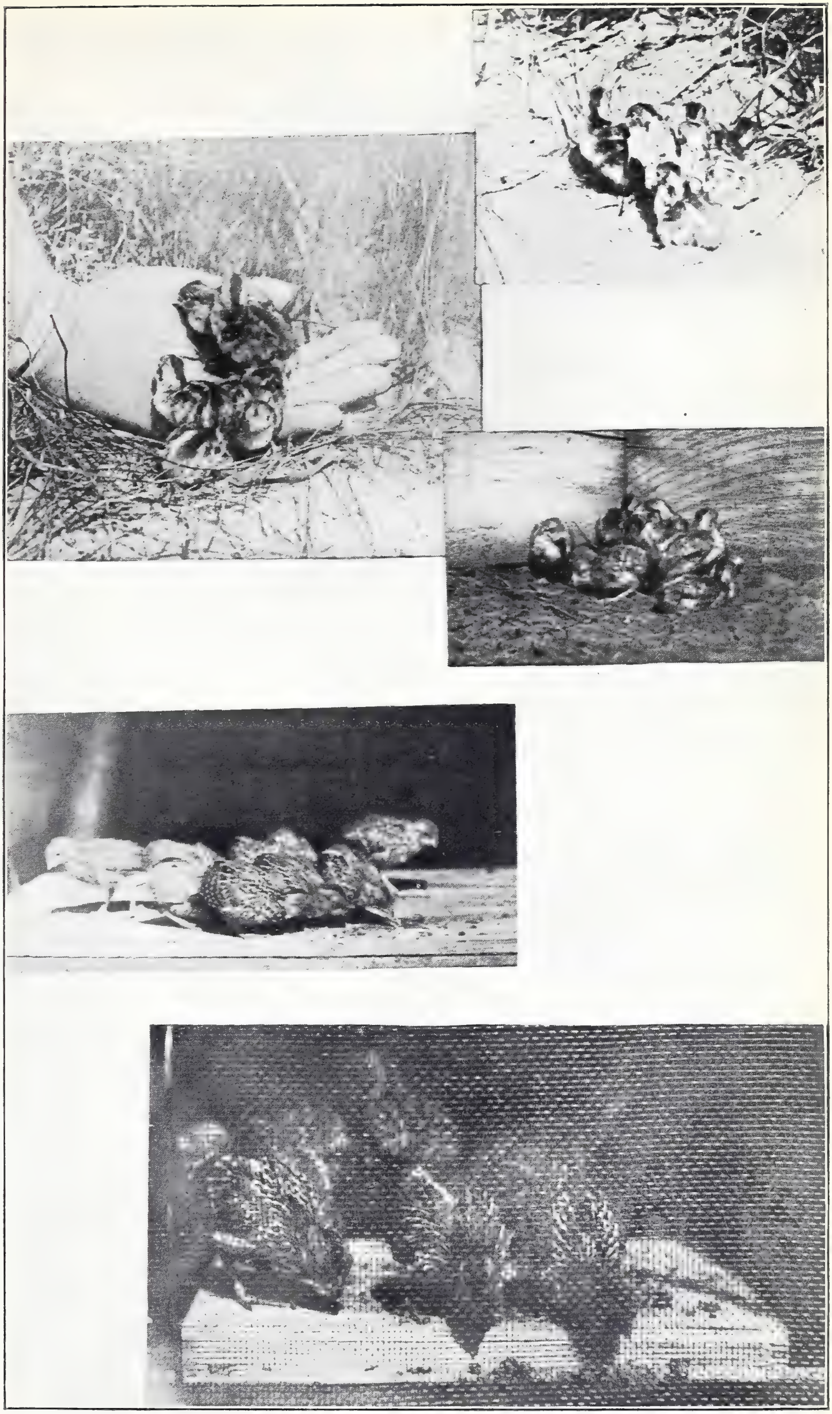
(*b*) *Lice.* — Head or body lice can be controlled by the use of a good lice powder worked under the feathers once a week, the last time just previous to hatching. This work is of great importance, for the chicks will become quickly infected if any lice are on the hen, and an infestation that would be harmless to chickens might be fatal to pheasants.

Night lice or spider mites are troublesome in driving the setting hens from their nests, and cannot be controlled by the use of powder, while oil and disinfecting solutions are not safe to use when eggs are in the nests. In case of infection, the nest should be changed and box oiled before further use.

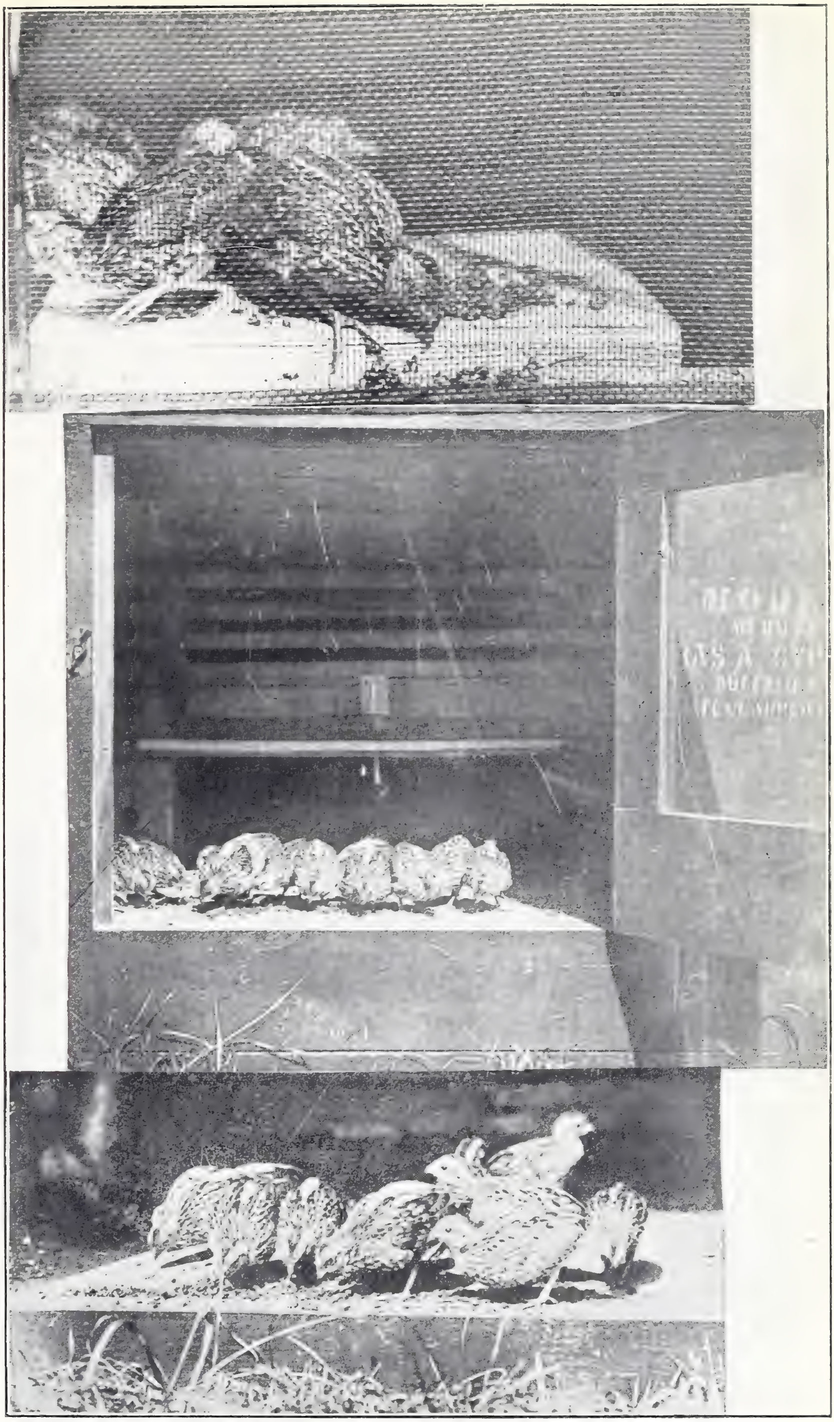
The proper time for airing and cooling is not definitely established, but half an hour is recommended. The hen should be shut off the nest, and this time taken for examining the eggs and cleaning where necessary. If mites are in the nest they will often crawl to the warm eggs as soon as the hen is taken away, and should be watched for.



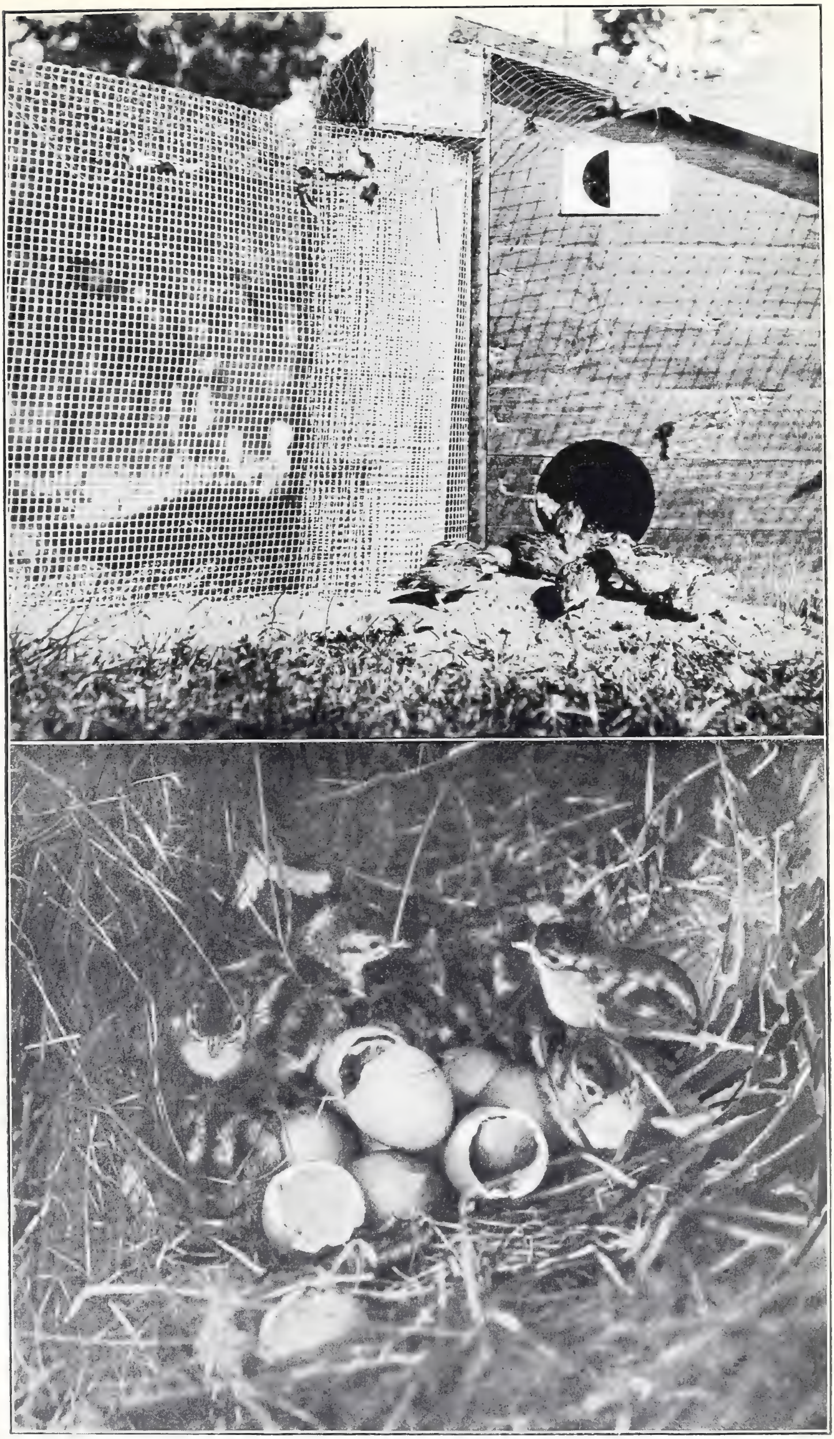
Upper portion of photograph, one of the quails' nest in our breeding pens. Center portion, "just out." Lower portion, "one day old."



Quail hatched and reared in confinement, in first and second views two days old. In third view, nine days old. In fourth and fifth views, fifteen days old.



Quail reared in confinement, 1906. In first view, fifteen days old (see also other photographs of quail of same age). In birds of this age note the longitudinal stripes on the feathers, similar to those of the adult migratory quail of Europe (*Coturnix coturnix*). In second view, eighteen days old. In third view, twenty-four days old.

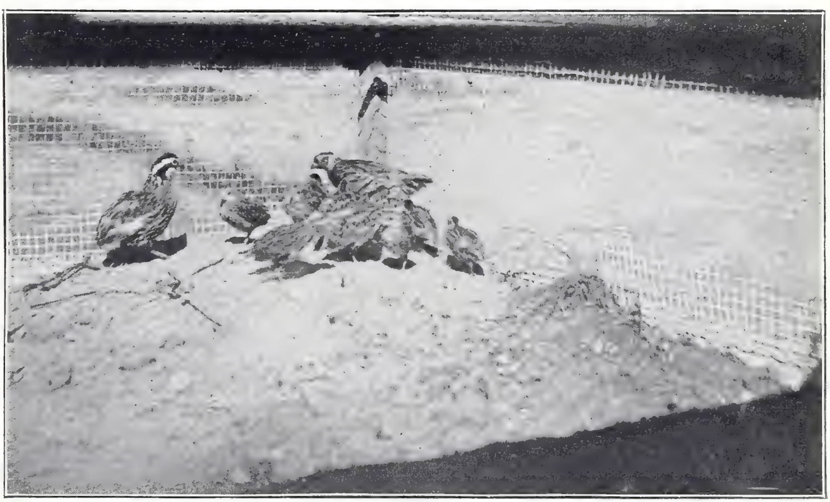


Upper portion of photograph, quail hatched and reared in confinement; birds in the yard, at entrance to brooder. Lower portion (from photograph by A. C. Hill, Belmont, Mass., June 7, 1906), pheasant's nest, with ten young and two eggs.

Young quail, hatched and reared by bantam hen. After the first week the young quail are allowed full liberty, the bantam being kept in a coop where she broods the young quail.

Quail reared in pens 12 by 12 feet; moved frequently to new ground.

Young quail (Bobwhite) reared in confinement.

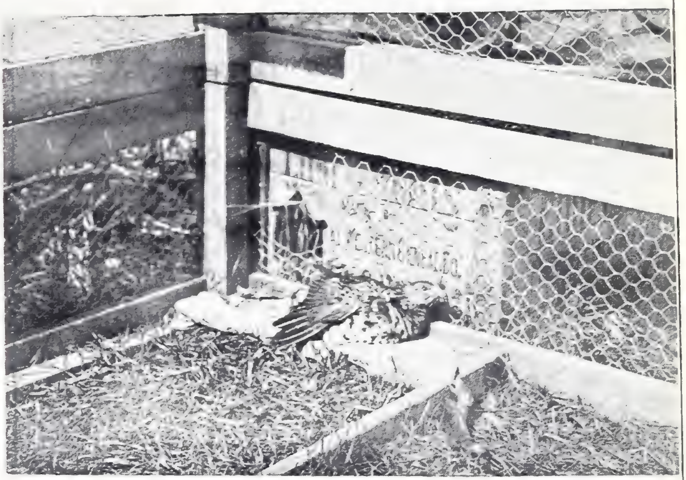


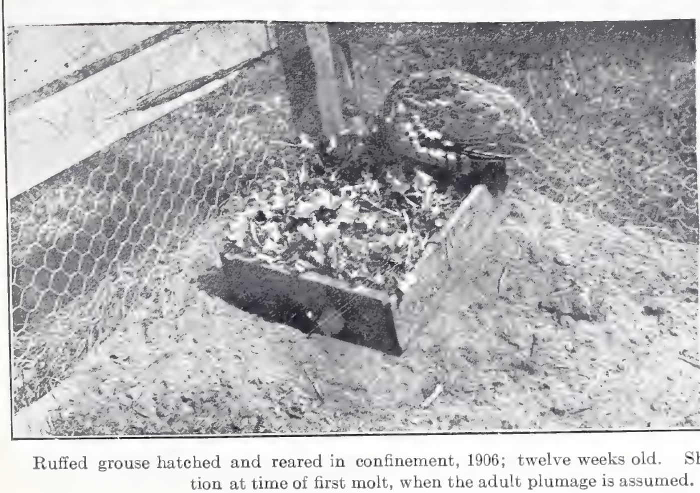
The bobwhites are permitted to incubate and rear the last clutch of eggs.

Bobwhite in the winter coops, Sutton hatchery.

The killdeer plover protecting its nest. This species is likely to become extinct in New England.

Three ruffed grouse, wing clipped, were put in a two-acre enclosure. Two hens made nests, and laid full complement of eggs.





Ruffed grouse hatched and reared in confinement, 1906; twelve weeks old. Showing condition at time of first molt, when the adult plumage is assumed.

Right: young ruffed grouse. The hen grouse was killed by a "self-hunting dog." The young were found by our deputy and were reared to maturity at Sutton hatchery. Left: breeding coops for Bobwhite.

Left: Sutton hatchery. Enclosure in which wild mallards nest. Right: details of nesting site.

Wild mallard ducks on nest, Sutton hatchery.

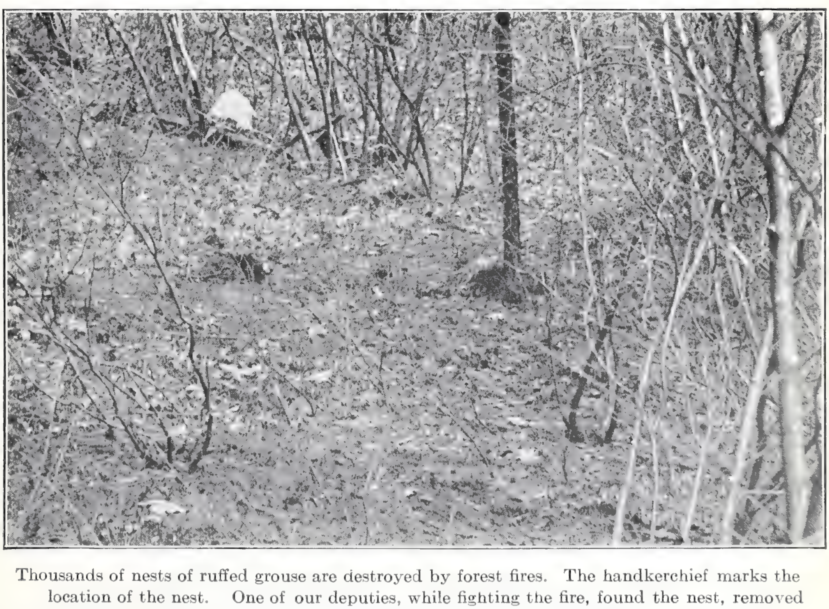
Pheasant nest destroyed by cat.

Pheasant's nest destroyed at 10 P.M. by cat. The hen pheasant was caught on the nest, and eaten.

Remains of ruffed grouse which was killed and eaten by cat.

Our alien foreign-born citizens are adepts at snaring birds in violation of law. Horse-hair nooses are effective and are difficult to detect until they have done their work. Only four of the six robins killed are shown here.

Bobwhite in the "family circle." The characteristic position of flock when at rest.



Thousands of nests of ruffed grouse are destroyed by forest fires. The handkerchief marks the location of the nest. One of our deputies, while fighting the fire, found the nest, removed the eggs to a place of safety, and succeeded in putting out the fire before it reached the nest. The eggs were replaced in the nest, and every egg was hatched by the grouse.

If not observed on the eggs, the box should be examined for the fecal droppings about the cracks, which indicate their presence.

The hatching will be more uniform if the hens are changed regularly on the nests; this can be done best by shifting each hen to the next coop when taken off for airing, and a new hen placed on each nest daily for several days. There is little danger of breaking up the hens if this changing begins at the end of the first week of setting. A rotation of hens can be obtained by using a stack of nests, and allowing the hens to mix in the pens before returning to the nests.

If brooders are used for rearing, it is advised that the hatching be finished in incubators, and the chicks kept free from lice. Where hens are used for rearing, incubators are useful for holding the chicks until the hen can be tested, for many hens will not own a game bird chick. Pheasant chicks can be given free run in five to seven days when reared with hens. If the number is much reduced, the hens which caused the loss should be removed, and their chicks given to the others.

If head lice appear in the chicks, usually in a week or ten days after hatching, lard applied to the head and neck of the chick will kill them. The best time to do this is on a warm sunny morning, when it will dry quickly. This should be repeated the following week.

When the chicks are three to four weeks old it is safe, in summer weather, to remove the hen, but if they are running at large, the presence of the hen is necessary to keep them from straying, and should be continued for six weeks or more.

Food. — Feeding should begin the second day, and should early include the foods intended to be used, as when once accustomed to a diet they are reluctant to change. Sour milk curd, custard, maggots, ant eggs, fresh or dried, and insects are practical foods at the start, and to these green food, berries, fine grain and weed seed can soon be added. A proper rotation should be observed by giving, after a rich food like custard or maggots, a diet of grain, milk or fruit. Skimmed milk is best for souring, but only the cleanest should be used. The curd can be strained out, or the whey absorbed by adding shredded wheat, bread crumbs or pheasant meal.

Custard is made by mixing skimmed milk with enough egg to give proper consistency; or it can be made less rich and more bulky by using fewer eggs and adding shredded wheat, bread or pheasant meal.

Ant eggs can be collected in small numbers from ant hills or under stones. Dried ant eggs are obtainable from bird dealers, and are easily prepared for feeding by merely scalding. Dried insects are also obtainable from bird dealers.

To produce maggots regularly requires considerable work. While hardly practical for work on a small scale, with proper location and equipment they can be produced regularly and in unlimited numbers, and where the work is extensive can be fed without waste.

Other foods which are valuable for growing birds when used in rotation with the richer foods are cooked potato, cooked grain, a mixture of rice and cracked corn, oats and barley, with bone meal and meat scrap.

The richer foods can be gradually discontinued after a month, and grain which has been fed in increasing amounts from the time the birds were a few days old can be largely increased, but some soft food, like mash, cooked grain and pheasant meal, and cooked or fresh raw meat should be continued until the birds are grown.

Green food can be supplied by previously planting lettuce, clover or buckwheat in the pens, or by planting in boxes and supplying as needed, or the plants can be chopped and mixed with their food. The old birds can be fed on these plants or any succulent weed, but the best way is to keep the birds in movable coops, which can be shifted often on grassy or weedy land. It is important to have the coops on fresh ground in order to keep the birds free from infection; and with quail, especially, the ground should not have been used for two or three years previously. Even if there is no likelihood of infection, the birds should be moved often, as frequent changes give them new ground to work on, and stimulates them to needed exercise.

Intestinal or digestive troubles, even without infection, are to be expected at any time among young birds, and are a source of constant and at times serious loss. Constant cleaning and disinfection of the coops and brooders, clean water and clean fresh food, with especial care taken to remove any that is uneaten and likely to become sour, will minimize the loss. The use of a 10 per cent. solution of lime water for young birds, increasing the strength as they grow up, is recommended as a preventive.

At the last molt, pheasants if closely confined begin a destructive feather eating, starting at the tail or wing quills, and as they rarely fail to do this if kept in large flocks, they should be split into smaller flocks and kept busy by frequently moving the coops. Generally in a flock suffering from this trouble one or more birds may be observed in good condition, with feathers uninjured. The removal of these, usually the offenders, often ends the trouble. Quail do not practice feather eating, but a few deaths may result from quarreling, or, more especially, by introducing a stranger into a flock.

Partridges.

The 100 European gray partridges, which were received Dec. 1, 1910, survived the winter with a loss of 24 from accidental causes and from inability to thrive in captivity. The early loss was among the weaker birds, and no evidence of an infectious disease was noticed. The birds were extremely wild, and no care could bring them to the same degree of tameness as the quail or grouse. This natural wildness was

undoubtedly the chief cause of failure to get results from mated birds, and must be overcome by different methods of handling or by the use of more suitable pens.

In order to allow these birds to select their own mates for successful breeding, a large yard about an acre in extent, with small mating pens attached, according to the French system, was built, and the birds, after wintering with the sexes separate, were put together in the large pen. As they paired they left the flock and sought retirement in the small pens. Within less than a month 37 pairs mated and were captured, leaving only 2 unmated males. All available kinds of breeding pens were tried, varying in size from 32 to 900 square feet. One bird laid 3 infertile eggs in a pen 32 feet square; 2 nested in the brush and weeds of the 600 square feet of quail pens and began incubation. The first bird produced 10 eggs, 5 of which were fertile, and from which 4 chicks were hatched under a hen, 3 reaching maturity. The second bird laid 12 eggs, 10 of which were fertile. From these 1 chick was hatched and grown in the brooder, but later was added to the first lot. The survivors after the first month showed a vigor and hardiness equal to the best of the quail or pheasants raised under like conditions. The second lot appeared comparable to the unsuccessful quail broods, where the chicks were hatched with a deficiency in vitality which rendered them unable to survive the conditions of brooder life or to digest substitutes for their natural food.

The young birds were very docile, although not as familiar as the grouse, which is the most tame game bird. They were contented in restricted quarters, showed no tendency to panic, like the quail, made little distinction between their attendants and strangers, and were more active in scratching for food than the quail or pheasants.

The work of the past season indicates that the gray partridge is not as easily propagated as the quail, since the care in mating is necessarily much greater, the captured stock remaining mostly barren in the restricted breeding pens. Even at the end of the season the birds showed little change in their attitude toward the captive life. For future work in breeding reliance is placed on the birds grown in captivity and upon the hardier wild ones which can be kept in captivity through the second breeding season in sufficiently large pens so that they will not feel the restraints of captivity. Open yards with patches of grain for cover would be the most practical way of providing the necessary environment. These yards could be used for other birds running free or in portable pens.

Respectfully submitted,

ARTHUR MERRILL,
Superintendent.

Enforcement of Law.

While it is highly desirable to have the widest degree of publicity in our activities, it is obviously impossible to take the public into confidence in all cases. Our deputies disclose their identity only when necessary, and many potential violators have been interviewed and "sized up" without their knowledge. For example, in the case of the dynamiting of a certain pond, when the newspapers and others were crying hysterically that the commission was doing absolutely nothing, as a matter of fact three deputies were working on the case day and night.

We note annually a decided improvement in public sentiment in reference to the fish and game laws. More individuals have come to realize that the unlawful killing of birds, to which all law-abiding citizens have equal rights, is really on a par with such despicable lawlessness as hen stealing or pocket picking; that game laws are as necessary to conserve public property in the country as the criminal code to protect private property in the city; and that it is as much the duty of every citizen to prevent illegal acts against birds and game as it is to apprehend a pickpocket in a crowd and to deliver him to the proper authorities.

The report of W. W. Nixon, chief deputy, in charge of law enforcement, follows: —

Boston, Mass., Jan. 1, 1912.

Commissioners on Fisheries and Game, State House, Boston, Mass.

Gentlemen: — I herewith submit my annual report as chief deputy for the year ending Dec. 31, 1911.

The deputy force of the past year consisted of a chief deputy and 29 paid deputies, who devote their entire time to the work. From September 15 to December 31, 7 special deputies, who devoted their entire time to the work, were also employed. On November 19, 8 additional special deputies were put on during the open season on deer, providing a force of 45 paid deputies during the week of November 20. In addition, 186 unpaid deputies were appointed.

The most important case of the year, the seizure of seven boxes containing 399 partridges, was made at Boston on October 19. The birds were packed and shipped as frozen mackerel, but notwithstanding the clever manner of smuggling the birds from Nova Scotia, they fell into the hands of our deputies, — a demonstration of the efficiency and

vigilance of our deputies. On the seizure of the birds, the matter was immediately taken up with the game commissioner at Halifax, with the result that the offender in Nova Scotia was convicted and fined. In Massachusetts the case is now pending in the Boston court, where favorable results are expected.

Another important case was the capture of an Italian, who was taken red-handed in the act of snaring song birds. He was convicted and fined $120. Deputy Stratton, who spent several days on this case, watching the snares by day and night, demonstrated the care and persistency with which our deputies follow up complaints. After Deputy Stratton had secured conclusive evidence of the violator's identity, Deputy Converse was sent to assist him in making the arrest. Cases of this type prove that our deputies are "on the job" at all times, and the knowledge should serve as a check to a class of violators who have given the most trouble.

At various times deputies of this department have been called upon by citizens to assist in work on which they have special knowledge. In one case, when an elk had been shot on a private estate, two of our deputies worked up all the evidence in a few days, and then turned the case over to the State police, who secured the conviction of the two violators, with a fine of $75 each.

From time to time complaints have been made to the office that our deputies do not perform their duties in a satisfactory manner. Many of these complaints are of a serious nature, but on investigation have generally proved unfounded. Again, many people confuse the work of the unpaid deputy, over whom we have no responsible control, with that of the paid deputy, who is at all times under direct control of the department. It is due to this fact that many complaints are made of laxity in the enforcement of law and conduct unbecoming an officer, for which the department is in no way responsible. If persons knowing of instances where paid deputies are, or have been in the past, guilty of improper conduct or neglect of duty, would report the facts to this office, investigations could be made and suitable action taken to remedy the defects in the service.

Assaults on Deputies. — Our deputies in the discharge of their duties are constantly in danger from unprincipled and vicious persons. Two instances of more or less serious assaults took place during this year. On Jan. 22, 1911, Deputy Stratton was attacked while arresting two men for illegal fishing. Notwithstanding the disadvantage, he succeeded in taking both violators, who were taken to court and fined, the one committing the assault paying an additional fine of $15.

The second instance occurred at Manchester on June 12, 1911. From time to time complaint had been made that a certain lobster fisherman was violating the law. Deputy Grant was assigned to the case, and, with the assistance of another deputy, overtook the boat in which the lobster fishermen were removing the meat from short lobsters. On

boarding the boat Deputy Grant was immediately seized by the captain, who ordered his men to throw everything overboard. The captain was taken to court for assault, and convicted. In addition, he lost about $300 worth of lobster meat.

Game. — The work of taking a census of the hunters in the field, which was started in 1910, was continued throughout the past year. Each deputy was instructed, when meeting a hunter in the covers, to get his name, the number of his hunting license, and the amount and kind of game in his possession. These statistics, which are filed at this office, in due time should furnish valuable data for intelligent legislation. During the year just closed the paid deputies of the department have met on the hunting grounds 2,665 hunters, who had the following game in their possession: —

Deer,	58	Geese,	6
Squirrels,	668	Ducks,	550
Rabbits,	572	Shore birds,	899
Foxes,	5	Pheasants,	1
Muskrats,	2	Pigeons (domestic),	8
Otters,	1	Crows,	4
Coons,	1	Egrets,	1
Partridge,	180	Loons,	5
Woodcock,	76	Blue jays,	1
Quail,	46		

In addition, the unpaid deputies report finding 107 hunters with a total record of 7 rabbits, 4 foxes, 15 squirrels and 2 partridges.

Bag Limit. — The largest reported bag of game was 53 gray squirrels shot by one man in a day. Another large bag of 47 ducks by one man was reported, while 249 ducks and 11 geese were obtained by a party with three guns. Such figures prove that a daily bag limit is needed in the interest of *bona fide* sport. All true sportsmen should be in favor of such a law for the benefit of legitimate sport and for the elimination of the pot hunter and game hog.

Game sealed in Cold Storage. — Since 1906 various quantities of game have been sealed in cold storage, according to law, by the deputies of this department. The following table gives the number of plover, quail, partridges, ducks and geese placed under seal during the five years from 1907 to 1911 inclusive: —

	1907.		1908.		1909.		1910.		1911.	
	Number of Packages.	Number of Birds.	Number of Packages.	Number of Birds.	Number of Packages.	Number of Birds.	Number of Packages.	Number of Birds.	Number of Packages.	Number of Birds.
Plover,	12	1,066	–	–	–	–	–	–	3	153
Quail,	78	4,788	49	3,048	15	845	2	46	7	553
Ducks and geese,	118	2,658	52	1,250	71	1,833	111	2,731	193	4,337
Partridge,	–	–	–	–	1	5	–	–	1	6[1]
	208	8,512	101	4,298	87	2,683	113	2,777	204	5,049

During the year deputies of this department have sealed at the various cold-storage plants in Boston, 204 packages, containing 5,049 wild fowl, shore birds and quail.

Black duck,	2,336	Canvasback,	58
Duck,	18	Plover,	45
Mallards,	248	Yellowlegs,	108
Redheads,	100	Quail,	553
Butterballs,	330	Wild geese,	7
Widgeon,	262	Green-winged teal,	984

Wild Fowl from Other States. — Wild fowl brought into Massachusetts from other States, under permits issued by the Fish and Game Commission, from Jan. 1, 1911, up to and including Dec. 31, 1911, according to the provisions of chapters 421 and 508, Acts of 1909, are listed below. The total number of permits issued was 58.

Geese,	68	Teal,	13
Brant,	7	Blackheads,	16
Black ducks,	101	Bluebills,	14
Mallards,	417	Shovelers,	6
Redheads,	3	Swan,	1
Widgeon,	128	Dippers,	3
Canvasbacks,	1	Sheldrake,	6
Ducks,	120		
Gadwell,	6		910

Sea Fowl. — Sea fowl have been reported as more numerous during the past season than for a number of years, particularly in Quincy and Hingham harbors. Heavy flights of shore birds have been seen on the Lynn and Newburyport marshes.

[1] This package contained also 10 woodcock.

Deer. — Certain changes should be made in the deer law, a few of which are here mentioned.

Provision should be made to allow hunters, with permission of owners, to enter upon posted land for the purpose of killing and removing deer which have been wounded by them legally on unposted land, without being liable for trespass. Hunters should be required to give their license numbers when reporting to this office the wounding or killing of deer, in order to facilitate matters in compiling the records. Provision should also be made for the disposal of the deer shot in the act of destroying crops by farmers, either by selling the carcass or by distributing the meat to the poor in the vicinity.

The number of deer shot by farmers while damaging crops was 232, as compared with 16 in 1907, 17 in 1908, 198 in 1909, and 327 in 1910, showing a decrease over the previous year. Below is given a summary by counties of the number of deer shot under chapter 545, Acts of 1910, the amount of damage claimed by the owners of the damaged property, and the deputies' estimates: —

County.	Number killed.	Owners' Estimates.	Deputies' Estimates.
Barnstable,	1	–	–
Berkshire,	17	$96 50	$80 70
Bristol,	–	–	–
Dukes,	–	–	–
Essex,	1	15 00	15 00
Franklin,	90	545 00	515 20
Hampden,	40	168 25	183 75
Hampshire,	44	258 75	155 65
Middlesex,	14	160 00	52 00
Norfolk,	2	150 00	40 00
Plymouth,	–	–	–
Suffolk,	–	–	–
Worcester,	23	177 80	57 80
Total,	232	$1,571 30	$1,100 10

Damage by Wild Deer. — The following table gives a comparative statement of the damage by wild deer during the years 1906, 1907, 1908, 1909, 1910 and 1911.

A Comparative Statement of Damages by Wild Deer from 1903 to 1911 inclusive.

Counties.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.
Barnstable,	–	–	–	–	–	–	–	–	$12 00
Berkshire,	–	–	–	$143 00	$324 50	$278 00	$512 00	$452 40	373 00
Bristol,	–	–	–	–	20 00	35 00	85 00	124 75	99 00
Dukes,	–	–	–	15 00	–	–	–	–	–
Essex,	–	–	–	469 18	683 50	453 82	345 50	286 00	445 60
Franklin,	–	–	–	477 00	793 25	1,415 78	3,793 05	3,363 10	2,905 35
Hampden,	–	–	–	214 30	156 00	199 00	410 50	779 00	1,588 05
Hampshire,	–	–	–	295 25	263 90	326 00	746 75	585 90	2,556 67
Middlesex,	–	–	–	–	445 63	1,016 83	615 42	879 73	605 65
Norfolk,	–	–	–	–	15 00	–	20 00	9 80	79 00
Plymouth,	–	–	–	39 00	–	–	20 00	–	251 00
Worcester,	–	–	–	370 00	211 00	645 60	1,374 87	871 16	611 50
Total,	$237 30	$392 25	$1,117 05	$2,022 73	$2,912 78	$4,370 03	$7,923 09	$7,351 84	$9,526 82

	1909.	1910.	1911.
Total number of claimants,	524	411	418
Average cost per claimant,	$15 12	$17 89	$22 79
Smallest claimant, amount received,	50	1 00	1 00
Largest claimant, amount received,	175 00	140 00	1,873

Summary of Deer Statistics, 1907, 1908, 1909, 1910 and 1911.

	1907.	1908.	1909.	1910.	1911.
Killed during open season,	–	–	–	1,281	1,270
Seen chased by dogs,	114	120	71	26	10
Seen damaging crops,	85	100	227	358	242
Shot illegally,	40	36	49	64	30
Killed by trains and trolley cars,	25	60	55	50	25
Dead from other causes (dogs, drowning, etc.),	47	83	82	157	77
Shot while damaging crops,	16	17	198	327	232

Summary of Deer Reports for 1911.

County.	Seen.	Seen chased by Dogs.	Seen damaging Crops.	Shot illegally.	Killed by Cars.	Dead from Other Causes.	Shot while damaging Crops.
Barnstable,	23	–	–	–	–	1	1
Berkshire,	164	1	4	3	6	11	17
Bristol,	40	–	–	2	2	2	–
Essex,	92	–	–	2	1	4	1
Franklin,	106	–	110	1	2	8	90
Hampden,	419	1	34	2	7	8	40
Hampshire,	114	–	28	3	–	13	44
Middlesex,	115	3	32	12	1	5	14
Norfolk,	119	–	–	1	–	1	2
Plymouth,	59	2	–	–	1	3	–
Suffolk,	2	–	–	–	–	–	–
Worcester,	355	3	34	4	5	21	23
Total,	1,608	10	242	30	25	77	232

Open Season for Deer. — The returns from the open season for deer, from November 20 to 25, inclusive, gave a total of 1,270 killed, as compared with 1,281 for 1910. Five violations of the deer law were made during the open season, as follows: —

Hunting in Middlesex County. Discharged Nov. 22, 1911.

Two nonresidents with $10 licenses, November 24. Filed; $4.60 each with costs.

Having in possession more than 1 deer. Discharged.

Killing deer with rifle. Fine, $15; costs, $7.60.

Killing deer without license. Fine, $50.

Returns of the Deer killed during the Open Season in Massachusetts, 1911.

Berkshire County.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Adams,	3	2	1	–	–
Agawam,	5	–	4	–	1
Alford,	3	1	–	–	2
Becket,	19	10	9	–	–
Cheshire,	12	6	6	1	–
Dalton,	1	–	1	–	–
Egremont,	5	3	2	–	–
Florida,	10	4	6	–	–
Great Barrington,	3	–	2	2	1
Hancock,	4	2	1	–	1
Hinsdale,	5	4	1	–	–
Lanesborough,	6	5	–	–	1
Lee,	5	4	1	–	–
Lenox,	2	1	1	–	–
Monterey,	4	3	1	1	–
Mount Washington,	11	5	6	–	–
New Ashford,	6	3	3	–	–
New Marlborough,	2	2	–	–	–
North Adams,	4	2	2	1	–
Otis,	11	5	3	1	3
Peru,	5	2	3	–	–
Pittsfield,	10	6	4	1	–
Richmond,	14	4	8	2	2
Sandisfield,	9	5	3	–	1
Savoy,	5	3	2	–	–
Sheffield,	18	6	7	–	5
Stockbridge,	2	2	–	–	–
Tyringham,	5	3	2	–	–
Washington,	10	6	3	–	1
West Stockbridge,	10	5	5	1	–
Williamstown,	10	5	5	–	–
Windsor,	11	8	3	–	–
	230	117	95	10	18

Returns of the Deer killed during the Open Season in Massachusetts, 1911 — Continued.

Franklin County.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Ashfield,	16	8	4	-	4
Bernardston,	12	7	4	-	1
Buckland,	12	2	6	1	4
Charlemont,	5	1	2	1	2
Colrain,	13	4	2	-	7
Conway,	15	6	5	-	4
Deerfield,	19	10	3	2	6
Erving,	10	9	1	-	-
Gill,	9	4	4	-	1
Greenfield,	6	2	4	-	-
Hawley,	16	4	7	-	5
Heath,	9	5	3	-	1
Leverett,	11	4	4	-	3
Leyden,	6	2	3	-	1
Monroe,	7	5	2	2	-
Montague,	16	5	6	1	5
New Salem,	9	7	2	1	-
Northfield,	16	6	7	-	3
Orange,	8	2	4	-	2
Rowe,	16	6	5	-	5
Shelburne,	9	5	2	1	2
Shutesbury,	8	2	3	-	3
Sunderland,	2	2	-	-	-
Warwick,	11	4	7	-	-
Wendell,	16	11	4	-	1
Whately,	5	5	-	-	-
	282	128	94	9	60

Hampden County.

Blandford,	18	13	4	2	1
Brimfield,	16	11	1	-	4
Chester,	21	13	7	-	1
Chicopee,	2	1	-	-	1
East Longmeadow,	3	1	1	-	1

Returns of the Deer killed during the Open Season in Massachusetts, 1911 — Continued.

Hampden County — Concluded.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Granville,	21	15	5	–	1
Hampden,	4	3	1	–	–
Holland,	1	1	–	1	–
Holyoke,	2	2	–	–	–
Longmeadow,	9	4	4	1	1
Ludlow,	34	22	7	–	5
Monson,	10	3	4	2	3
Montgomery,	3	1	1	–	1
Palmer,	13	4	8	3	1
Russell,	4	2	2	–	–
Southwick,	16	7	3	–	6
Springfield,	2	1	1	–	–
Tolland,	11	7	2	–	2
Wales,	4	3	1	–	–
Westfield,	5	3	2	–	–
Wilbraham,	15	6	5	–	4
	214	123	59	9	32

Hampshire County.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Amherst,	8	3	2	–	3
Belchertown,	19	10	7	–	2
Chesterfield,	16	8	4	1	4
Cummington,	9	–	5	–	4
Enfield,	12	7	3	2	2
Goshen,	6	3	–	–	3
Granby,	6	5	1	–	–
Greenwich,	8	5	3	1	–
Hadley,	4	3	1	–	–
Hatfield,	2	2	–	–	–
Huntington,	15	9	5	–	1
Middlefield,	14	6	4	–	4
Northampton,	5	3	2	1	–
Pelham,	14	8	2	–	4
Plainfield,	2	–	2	1	–

Returns of the Deer killed during the Open Season in Massachusetts, 1911 — Continued.

Hampshire County — Concluded.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Prescott,	16	11	3	2	2
Southampton,	3	1	2	–	–
Ware,	12	5	5	2	2
Westhampton,	7	5	2	1	–
Williamsburg,	7	3	4	1	–
Worthington,	24	9	12	–	3
	209	106	69	12	34

Worcester County.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Ashburnham,	2	1	1	–	–
Athol,	12	4	4	–	4
Barre,	20	10	6	1	4
Berlin,	2	1	–	–	1
Blackstone,	2	2	–	1	–
Bolton,	2	2	–	–	–
Boylston,	1	1	–	–	–
Brookfield,	8	2	4	–	2
Charlton,	1	1	–	1	–
Clinton,	1	–	1	–	–
Dana,	3	3	–	–	–
Douglas,	6	3	2	1	1
Gardner,	4	1	3	–	–
Hardwick,	30	17	8	1	5
Harvard,	11	7	4	–	–
Holden,	9	7	2	–	–
Hubbardston,	26	10	16	–	–
Lancaster,	13	8	1	1	4
Leicester,	1	1	–	–	–
Leominster,	2	1	1	–	–
Lunenburg,	15	9	4	–	2
New Braintree,	3	1	2	–	–
Northborough,	2	1	1	–	–
North Brookfield,	4	–	2	1	2
Oakham,	9	4	4	1	1

Returns of the Deer killed during the Open Season in Massachusetts, 1911 — Concluded.

Worcester County — Concluded.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Paxton,	2	2	–	–	–
Petersham,	8	7	1	1	–
Phillipston,	16	6	7	1	3
Princeton,	7	2	4	1	1
Royalston,	6	5	–	–	1
Rutland,	6	3	3	–	–
Southborough,	1	–	1	–	–
Southbridge,	2	1	1	–	–
Spencer,	20	11	7	–	2
Sterling,	3	2	1	–	–
Sturbridge,	6	4	2	–	–
Templeton,	11	5	6	2	–
Upton,	6	2	4	2	–
Uxbridge,	4	2	2	–	–
Warren,	8	4	2	–	2
Webster,	4	3	1	–	–
Westborough,	2	1	–	–	1
West Boylston,	5	4	1	–	–
West Brookfield,	8	4	4	–	–
Westminster,	8	4	1	–	3
Winchendon,	11	6	5	–	–
	333	175	119	15	39

Summary.

	Total killed.	Buck.	Doe.	Wounded.	No Sex given.
Berkshire,	230	117	95	10	18
Franklin,	282	128	94	9	60
Hampden,	214	123	59	9	32
Hampshire,	209	106	69	12	34
Worcester,	333	175	119	15	39
	1,268	649	436	55	183

The passage of chapter 138, enacted in 1901, gave the Commissioners on Fisheries and Game and their deputies authority to arrest persons for taking shellfish in contaminated waters when so requested by the

State Board of Health. This act was first applied to the local waters of New Bedford and Fairhaven in 1904. In 1911, an act, chapter 411, was passed, which became operative on June 5, 1911, creating a local board of shellfish commissioners, to have charge of shellfish taken in contaminated waters in that vicinity, with authority to make all regulations. Up to June 5, 12 arrests, with fines of $200, were made, but under the new law no action is necessary. The same act as applied to Boston and Quincy waters in 1911 resulted in 44 arrests, with fines of $262, and as applied to the waters of Lynn, Revere and Saugus gave a record of 10 arrests and fines of $75.

Distribution of Fish. — The planting of trout fry in the spring and fingerlings in the fall requires the services of men experienced in handling and caring for fish. The deputies trained for this work are required at such times to give their entire attention to distributing the fish, thus preventing their active participation in the enforcement of law. As many as ten deputies have been detailed for this work at one time. In years previous to 1911 consignments of fish were delivered to applicants at the railroad station nearest to the brook in which the fish were to be planted. This plan was not entirely satisfactory for various reasons, and this year our deputies were instructed to accompany each of their consignments to the place of distribution, in order that the fish might be placed in suitable waters. In this way the danger of placing the fish in posted brooks or polluted streams was avoided. This plan, I believe, worked to the satisfaction of the sportsmen, who have complained at times of improper care in stocking public waters. In addition to the trout, 1,069 adult white perch, averaging perhaps three quarters of a pound, were distributed to various ponds.

Egg Lobsters. — The total number of egg-bearing lobsters collected by this department during the year 1911 was 3,169. Of these, 2,397 were liberated and the remainder sold to the United States Bureau of Fisheries, 496 going to the Woods Hole hatchery and 276 to the Gloucester hatchery.

Forest Fires. — The number of forest fires discovered and extinguished by paid deputies during the year was 49. In connection with this work, one arrest was made for setting a forest fire, and the party fined $5. Some of the deputies have spent whole days fighting forest fires, and have otherwise rendered valuable assistance in this work. The following table will show the number of fires discovered and put out by the paid deputies: —

Deputy.	Number of Fires.	Deputy.	Number of Fires.
J. E. Bemis,	9	J. I. Mills,	7
G. H. Brown,	1	N. W. Pratt,	3
T. L. Burney,	1	L. E. Ruberg,	5
I. O. Converse,	2	W. W. Sargood,	4
F. W. Goodwin,	5	D. F. Shea,	1
A. Keniston,	1	A. L. Stratton,	3
W. A. Larkin,	3	F. R. Zeigler,	1
W. H. Leonard,	3	Total,	49

Laws. — At the legislative session of 1911, 88 bills were introduced relative to fish and game laws, which do not include 19 recommendations made by the fish and game commission. Of this number, 26 either became laws or made suitable amendments to existing laws.

Respectfully submitted,

WILLIAM W. NIXON,
Chief Deputy.

RECOMMENDATIONS FOR LEGISLATION.

The Commissioners on Fisheries and Game respectfully recommend the passage of laws designed to accomplish the following purposes: —

1. The appointment, by the Commissioners on Fisheries and Game, of a suitable person in every town in the Commonwealth as a town game warden, to have duties and powers identical with those of the present deputy commissioners on fisheries and game, and to act under the authority and the instructions of the commissioners. Compensation not to exceed $50 annually, one-half to be paid by the town and one-half by the State.

2. Of the money received by the Commonwealth for hunters' licenses, $10,000 should be appropriated annually for carrying out the provisions of Acts of 1911, chapter 410.

3. Five thousand dollars should be appropriated annually for stocking the public waters with food fish; for providing means of transportation of live fish; for stocking purposes; for conducting investigations and improving the conditions of public waters, and for the superintendence of such public waters;

and for carrying out such other measures as may from time to time appear to be necessary for increasing the yield of food fish in public waters.

4. To authorize the sale of the power boat now owned by the commission, known as the "Scoter;" for the sale of the Hadley hatchery; and for the transfer of the Winchester hatchery to the Metropolitan Park Commission.

5. To reimburse Chief Deputy William W. Nixon for injuries received during the performance of his duty.

6. Amendment to chapter 68, Resolves of 1911, relative to establishment of a fish hatchery.

7. Close season on black bass from April 1 to June 20 following.

8. A bag limit upon gray squirrels, 5 in any one day or 15 in a season; on ruffed grouse, 4 in any one day or 20 in a season; on woodcock and quail, 6 in any one day or 36 in a season.

9. A perfecting amendment to the Acts of 1911, chapter 614, section 11, relative to the forfeiture of hunters' licenses upon conviction.

10. To ensure economic utilization of the seashore area below high-water mark for the cultivation of clams and all other useful species of food and bait mollusks.

11. Such a modification of the laws relating to lobster fishing as to check the rapid decline of this fishery in Massachusetts waters. Of primary importance are (1) the protection of all adult lobsters of breeding age; (2) the use of only such traps as will prevent the catching of adults of breeding age.

12. To minimize the damage done to birds by cats and self-hunting dogs.

Courtesies.

Permits to hold egg-bearing lobsters in confinement, for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 458 fishermen and dealers.

Permits for taking birds and eggs under section 7, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, and further amended by chapter 250, Acts of 1907, were issued to the following-named persons: —

Henry P. Burt, New Bedford.
Albert H. Tuttle, Cambridge.
Charles R. Lamb, Cambridge.
George M. Gray, Woods Hole.
Robert O. Morris, Springfield.
B. G. Willard, Millis.
Rufus H. Carr, Brockton.
Chester S. Day, West Roxbury.
Edward R. Adams, Medfield.
F. A. Binford, Hyannis.
J. R. Mann, Arlington Heights.
Fred P. Hersom, Chelsea.
Chester A. Reed, Worcester.
Fred H. Kennard, Boston.
F. B. McKechnie, Ponkapog.
Frederic H. Carpenter, Taunton.
Frank S. Akin, Fall River.
William Brewster, Cambridge.
Haynes H. Chilson, Northampton.
A. C. Bent, Taunton.
Bartlett E. Bassett, Chathamport.
William S. Head, Westport.
Owen Durfee, Fall River.
William Dearden, Springfield.
James L. Peters, Cambridge.
H. C. Denslow, Hartford, Conn.

Permits to have *Anatidæ* in possession, for purposes of propagation, in accordance with the provisions of section 1, chapter 421, Acts of 1909, were issued to: —

William E. Ball, Fairhaven.
Henry B. Bigelow, Concord.
H. A. Boies, Assonet.
Seth A. Borden, Fall River.
Spencer Borden, Fall River.
Milan A. Brayton, Fall River.
John P. Bulger, Fairhaven.
W. W. Capen, Sharon.
Clark Chase, Jr., Fall River.
Alfred V. Freeman, South Duxbury.
J. Goulding, South Sudbury.
Guilford C. Hathaway and Benjamin Brown, Fall River.
Allan Keniston, Edgartown.
A. D. Kingsbury, Medfield.
H. S. Little, Newbury.
Miss E. W. Magee, Holliston.
Robert Montgomery, Natick.
Frederick E. Mosher, New Bedford.
John C. Phillips, Wenham.
William A. Read, New Bedford.
Lawrence Rogers, Byfield.
James E. Rothwell, Brookline.
William H. Thurston, Chiltonville.
R. E. Warren, Sharon.
Frank E. White, Saundersville.

Permits to bring into the Commonwealth during the close season not exceeding fifty birds known as *Anatidæ*, in accordance with the provisions of section 2, chapter 241, Acts of 1909, were issued to: —

James W. Austin, Boston.
Charles B. Barnes, Jr., Boston.
Thomas F. Baxter, Boston.
John H. Beebe, Wakefield.
Henry B. Bigelow, Concord.
John P. Blakeman, Boston.
J. F. Boyden, Norwood.
John Boyle, Peabody.
Clifton L. Bremer, Boston.
Gorham Brooks, Boston.
A. B. Clark, Peabody.
James M. Codman, Brookline.
Edward Cunningham, Boston.
Charles P. Curtis, Boston.
F. W. Curtis, Boston.
Charles W. Dabney, Westwood.
Livingston Davis, Milton.
Daniel Dewey, Boston.
E. H. Ellison, Boston.
H. B. Endicott, Boston.
H. W. Endicott, Boston.
Henry H. Fay, Jr., Boston.
Herbert E. Gale, Haverhill.
W. G. Garritt, Brookline.

Norman F. Greeley, Boston.
Samuel Hammond, Boston.
Arthur T. Harris, Boston.
Alexander Henderson, Boston.
Joseph M. Herman, Boston.
Edwin H. Hildreth, Springfield.
J. Hurd Hutchins, Boston.
Eben D. Jordan, Boston.
John M. Lilly, Weston.
Charles T. Lovering, Jr., Boston.
Arthur Lyman, Boston.
George H. Lyman, Boston.
Theodore Lyman, Cambridge.
F. S. Mead, Boston.
William Gordon Means, Beverly Farms.
Chas. G. Mixter, Boston.
George Mixter, Boston.
S. J. Mixter, Boston.
J. C. Neely, Brookline.
James H. North, Boston.
Eben C. Norton, Norwood.
Dudley L. Pickman, Boston.
Joseph B. Russell, Boston.
Geo. Cheever Shattuck, Boston.
Thomas Silsbee, Boston.
James W. Spring, Boston.
Bayard Thayer, Boston.
William G. Titcomb, Boston.
C. L. Tyler, Boston.
Arthur Wainwright, Boston.
Roger S. Warner, Boston.
Moses Williams, Boston.
Ralph B. Williams, Boston.
Robert W. Williams, Brookline.

Permit to bring into the Commonwealth during the close season not exceeding fifty birds known as *Limicolæ* or *Rallidæ*, in accordance with the provisions of section 2, chapter 508, Acts of 1909, was issued to: —

Arthur T. Harris, Boston.

Permits to have quail in possession, for purposes of propagation, were issued to: —

Isaac Blanchard,[1] South Westport.
H. A. Boies, Assonet.
Seth A. Borden, Fall River.
Spencer Borden, Fall River.
John Goulding, South Sudbury.
A. Hibbs, Lynn.
A. D. Kingsbury,[1] Medfield.
William H. Leonard,[1] East Foxborough.
George M. McNeil, Winthrop.
Joseph H. Mosher,[1] Wilkinsonville.
James E. Rothwell, Brookline.
Charles Sabins,[1] South Westport.
Arthur E. Walker, Maynard.
Frank E. White, Saundersville.

Permits to have ruffed grouse in possession, for purposes of propagation, were issued to: —

Seth A. Borden, Fall River.
H. A. Boies, Assonet.
James E. Rothwell, Brookline.
Arthur E. Walker, Maynard.

Permits to have native insectivorous birds in possession, for experimental purposes, were issued to: —

Seth A. Borden, Fall River.
James E. Rothwell, Brookline.

[1] Permits were only for the capture of quail.

Permit to take the nests of birds, after they have been vacated, for purposes of study, was issued to: —

Arthur A. Osborne, Peabody.

Permit to have in possession, for scientific purposes, ruby-throated humming birds, was issued to: —

Katherine Dolbear, Worcester.

Permit to shoot sea birds, for scientific investigation, was issued to: —

Vinal N. Edwards, Woods Hole.

Permits to trap rabbits, in accordance with the provisions of chapter 118, Acts of 1911, were issued to: —

Richard Goodwin, Lenox.
S. G. Warren, Leicester.

Permits to rear and sell pheasants, in accordance with the provisions of chapter 309, Acts of 1909, were issued to: —

Andrew S. Coyle, Taunton.
Minnie Blagden, Rowley.
H. S. Little, Newbury.
A. L. Millett, Rowley.
Milan A. Brayton, Fall River.
G. L. Winthrop, Lenox.
Elmer A. Macker, North Grafton.
Chester H. Keyes, Middleborough.
S. B. S. Keyes, Middleborough.
J. Goulding, South Sudbury.
George M. Ballard, Danvers.
Seth A. Borden, Fall River.
John C. Phillips, Wenham.
Spencer Borden, Fall River.
Frederick E. Mosher, New Bedford.
J. E. Rothwell, Brookline.
W. H. Palmer, Beverly.
Allan Keniston, Edgartown.
Mrs. Annie E. Freeman, Provincetown.
A. D. Kingsbury, Medfield.
Edward B. Woodbury, Topsfield.
Thomas Mallery, Natick.
Robert Montgomery, Natick.
Robert W. Harwood, Natick.
William A. Reed, New Bedford.
Theodore K. Grimsby, Essex.
Isaac U. Wood, Fall River.
Frank E. White, Saundersville.
Albert A. Hall, Lowell.
Joseph Gardella, Haverhill.
Mrs. Alexander Gilmore, Fayville.
Edward F. Parmlee, Boston.
George McNeil, Winthrop.
Clarence C. Puffer, Brockton.
Charles Whittemore, Newton.
Charles S. Knight, Westborough.
E. S. Gross, Middleborough.
Frank A. Webster, South Framingham.
George A. Finley, Arlington Heights.
W. L. Perkins, Middleborough.
Frank J. Estes, Lynn.
Charles M. Hazan, Beverly.
Joseph J. Demenkow, Whitman.
Uriah W. Boyden, Foxborough.
Theodore C. Browne, Salem.
George L. Bartlett, Rowley.

Howard C. Noyes, Newburyport.
Moses Lufkin, Gloucester.
Roger H. Smith, Peabody.
W. F. Chase, Lynn.
Travers D. Carman, Tolland.
Carl F. Hallin, Saugus.
Fred N. Marchant, Gloucester.
A. Hibbs, Lynn.
E. J. Robinson, Lakeville.
H. A. Boies, Assonet.
J. William Haskell, Lynn.
Lyman B. Perley, Rowley.
Charles M. Douns, Newburyport.
Paul Mange, Millbury.
Ernest R. Crowell, Bay View.
Ralph Thurlow, Newburyport.
Robert R. Alexander, Maynard.
Carlton Noyes, Newburyport.
William E. Ball, Fairhaven.
F. M. Tompkins, Dighton.
Russell S. Eastman, Dodge.
Fred D. Briggs, Wareham.
E. W. Staples, Taunton.
Howard Reilly, Cambridge.
Kirby S. Ducayet, Newtonville.
Charles L. Spalding, Beverly.
Howard C. Tebo, Essex.
John Lavine, Arlington.
William F. Chase, Wollaston.
Arthur E. Walker, Maynard.
Daniel Spencer, Ipswich.
Charles Barker, Gloucester.
Alfred G. Smith, South Braintree.
Alfred F. Smith, South Braintree.
Adrienne Pickering, Rumford, R. I.
Leroy F. Clarke, Wenham.
Charles B. Snow, Whitman.
W. S. Palmer, Dedham.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to the following persons: —

Elmer A. Durgin, Rowley.
Harry W. G. Graf, Newburyport.
A. P. Hilton, Newburyport.
John Hogan, Newburyport.
Edgar A. Johnson, Newburyport.
James H. Thurlow, Newburyport.
George E. Pettingill, Newburyport.
Napoleon N. Valli, Newburyport.
Leslie C. Woods, Newburyport

Permit to take lamprey eels, for scientific purposes, was issued to: —

George M. Gray, Woods Hole.

Permits to plant fish in State waters, in accordance with the provisions of chapter 185, Acts of 1911, were issued to: —

R. A. Taber, Brockton.
Bernard W. Stanley, Waltham.
James Clark, Plymouth.
James H. Wainwright, New York.
J. M. Van Huyck, Lee.
H. B. Sees, Pittsfield.
Willis S. Holt, Lowell.

Permit to transfer fish to satisfactory spawning grounds was issued to: —

Louis E. Vose, East Walpole.

Permits to seine in the ponds or rivers of the Commonwealth, for the purpose of securing fish for scientific purposes, were issued to: —

Allen A. David, Taunton.
Albert A. Goff, Raynham.
Everett B. Mecarta, Harwich.

Permit to operate one pound net in Buzzards Bay, for scientific purposes, was issued to: —

Marine Biological Laboratory, Woods Hole.

Permit to have in possession lobsters of any size, for scientific purposes, was issued to: —

Marine Biological Laboratory, Woods Hole.

Permits to have in possession, at any season of the year, fish of any size, for purposes of study, were issued to: —

W. C. Phillips, New Bedford.
L. W. Tilden, Fairhaven.
L. F. Potter, New Bedford.

Permits to buy and sell or have in possession trout artificially propagated and maintained, in accordance with the provisions of chapter 377, Acts of 1909, as amended by chapter 469, Acts of 1910, were issued to: —

Sandwich Trout Company, Sandwich.
A. R. Graham & Son, Berkley.
Jacob Diegel, Agawam.
Plymouth Rock Trout Company, Plymouth.
J. N. Westgate, East Freetown.
N. F. Hoxie, Plymouth.
William A. Gaston, Barre.
Charles R. Doten, Plymouth.
Prior & Mahoney, Boston.
Michael J. Welch, Boston.
Shattuck & Jones, Boston.
Lane Bros., Silver Lake.
J. N. Westgate, Myricks.
F. H. Johnson & Co., Boston.
C. M. Bassett, New Bedford.
Louis W. Tilden, Fairhaven.
H. L. Dakin Company, Worcester.
Boston Fresh Fish Company, Worcester.
City Fish Market, New Bedford.
Michael Wysock, Springfield.

G. W. FIELD.
G. H. GARFIELD.
G. H. GRAHAM.

APPENDICES.

[A.]

Deputy Fish and Game Commissioners, with the Number of their Districts, Residences and Telephones

William W. Nixon, *Chief Deputy,* Room 158, State House. Telephone, Hay., 2700; residence telephone, 2248–W Cambridge.

Assigned to District —	Name.	Residence.	Telephone Number.
1	William H. Jones,	Nantucket,	24–32
2	Charles L. Savery,	Vineyard Haven,	–
	Allan Keniston,	Edgartown,	6–21
3	Everett B. Mecarta,	Harwich,	36–4
4	Samuel J. Lowe,	New Bedford,	761–2
5	Allen A. David,	Taunton,	966–1
6	Nathan W. Pratt,	Middleborough,	153–4
7	Charles E. Tribou,	Brockton,	2101
8	– –	– –	–
9	William H. Leonard,	East Foxborough,	Foxborough 9–4
10	James E. Bemis,	South Framingham,	564–J
11	William W. Nixon, *Chief Deputy,*	Cambridge,	2248–W
	Frederick W. Goodwin,	East Boston,	515–2
12	Carl E. Grant,	Essex,	1–3
13	Walter A. Larkin,	Andover,	32–12
14	Thomas L. Burney,	Lynn,	1983–3
15	James I. Mills,	Ayer,	51–2
16	George H. Brown,	Millbury,	26–13
17	A. D. Putnam,	Spencer,	75–4 or 75–6
18	Irving O. Converse,	Fitchburg,	269–1
19	Albert L. Stratton,	Athol,	24–O
20	Dennis F. Shea,	Ware,	132
21	John F. Luman,	Palmer,	17–5
22	James P. Hatch,	Springfield,	2458–1
23	Charles H. Gehle,	Westfield,	843 or 920
24	– –	– –	–
25	Lyman E. Ruberg,	Greenfield,	585
26	Arthur M. Nichols,	North Adams,	537–2
27	Fred R. Zeigler,	Pittsfield,	362–11
28	William W. Sargood,	Lee,	119–24

The following were employed as special paid deputies: —

Name.	Residence.	Term of Service (1911).
Orrin C. Bourne,	Linden,	Nov. 20–Dec. 31.
John J. Connelly,	Webster,	Sept. 15–Nov. 30.
A. H. Eldredge,	Ware,	Oct. 7–Nov. 26.
Elmer W. Freeman,	East Pepperell,	Nov. 17–Nov. 26.
Warren A. Goff,	Dighton,	Sept. 15–Dec. 31.
Wm. E. Holland,	West Brimfield,	Nov. 17–Nov. 26.
Pliny D. Hunt,	Lee,	Nov. 17–Nov. 26.
Geo. W. Jourdian,	Northampton,	Sept. 15–Dec. 31.
Patrick J. Lee,	Northampton,	Nov. 17–Nov. 26.
Harry L. Lyford,	Spencer,	Nov. 17–Nov. 26.
Peter P. Monahan,	Westfield,	Sept. 15–Dec. 31.
Geo. C. Paradise,	Fall River,	Nov. 17–Dec. 19.
Geo. W. Piper,	Andover,	Sept. 15–Dec. 31.
Wm. N. Prentiss,	Milford,	Nov. 19–Nov. 26.
Wm. S. Richardson,	Scituate,	Sept. 15–Nov. 30.
Geo. W. Williams,	Worcester,	Aug. 19–Dec. 31.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included.

8 Abington.
15 Acton.
4 Acushnet.
26 Adams.
22 Agawam.
28 Alford.
13 Amesbury.
22 Amherst.
13 Andover.
11 Arlington.
18 Ashburnham.
18 Ashby.
25 Ashfield.
10 Ashland.
19 Athol.
5 Attleborough.
17 Auburn.
7 Avon.
15 Ayer.
3 Barnstable.
20 Barre.
27 Becket.
13 Bedford.
20 Belchertown.
9 Bellingham.
11 Belmont.
5 Berkley.
10 Berlin.
25 Bernardston.
12 Beverly.
13 Billerica.
16 Blackstone.
23 Blandford.
15 Bolton.
11 Boston.
3 Bourne.
15 Boxborough.
13 Boxford.
17 Boylston.
8 Braintree.
3 Brewster.
7 Bridgewater.
21 Brimfield.
7 Brockton.
17 Brookfield.
11 Brookline.
25 Buckland.
13 Burlington.
11 Cambridge.
9 Canton.
15 Carlisle.
6 Carver.
26 Charlemont.
21 Charlton.
3 Chatham.
15 Chelmsford.
11 Chelsea.
26 Cheshire.
23 Chester.
24 Chesterfield.
22 Chicopee.
2 Chilmark.
26 Clarksburg.
17 Clinton.
8 Cohasset.
25 Colrain.
15 Concord.
25 Conway.
24 Cummington.
27 Dalton.
20 Dana.
14 Danvers.
4 Dartmouth.
11 Dedham.
25 Deerfield.
3 Dennis.
5 Dighton.
16 Douglas.
10 Dover.
13 Dracut.
21 Dudley.
15 Dunstable.
7 Duxbury.
7 East Bridgewater.
22 East Longmeadow.
3 Eastham.
24 Easthampton.
7 Easton.
2 Edgartown.
28 Egremont.
20 Enfield.
19 Erving.
12 Essex.
11 Everett.
4 Fairhaven.
5 Fall River.
2 Falmouth.
18 Fitchburg.
26 Florida.
9 Foxborough.
10 Framingham.
9 Franklin.
4 Freetown.
19 Gardner.
2 Gay Head.
12 Georgetown.
25 Gill.
12 Gloucester.
24 Goshen.
2 Gosnold.
16 Grafton.
22 Granby.
23 Granville.
28 Great Barrington.
25 Greenfield.
20 Greenwich.
15 Groton.
13 Groveland.
22 Hadley.
7 Halifax.
12 Hamilton.
22 Hampden.
27 Hancock.
8 Hanover.
7 Hanson.
20 Hardwick.
15 Harvard.
3 Harwich.
24 Hatfield.
13 Haverhill.
26 Hawley.
26 Heath.
8 Hingham.
27 Hinsdale.
8 Holbrook.
17 Holden.
21 Holland.
10 Holliston.
22 Holyoke.
16 Hopedale.
10 Hopkinton.
19 Hubbardston.
10 Hudson.
8 Hull.
23 Huntington.
11 Hyde Park.
12 Ipswich.
7 Kingston.
6 Lakeville.
18 Lancaster.
27 Lanesborough.
13 Lawrence.
28 Lee.
17 Leicester.
28 Lenox.
18 Leominster.
25 Leverett.
14 Lexington.
25 Leyden.
10 Lincoln.
15 Littleton.
22 Longmeadow.
13 Lowell.
22 Ludlow.
18 Lunenburg.
14 Lynn.
14 Lynnfield.
14 Malden.
12 Manchester.
9 Mansfield.
14 Marblehead.
4 Marion.
10 Marlborough.
8 Marshfield.
3 Mashpee.
4 Mattapoisett.
15 Maynard.

Cities and Towns alphabetically arranged, with the Number of the District in which Each is included — Concluded.

9 Medfield.
14 Medford.
9 Medway.
14 Melrose.
16 Mendon.
13 Merrimac.
13 Methuen.
6 Middleborough.
23 Middlefield.
14 Middleton.
10 Milford.
16 Millbury.
9 Millis.
11 Milton.
26 Monroe.
21 Monson.
25 Montague.
28 Monterey.
23 Montgomery.
28 Mount Washington.
14 Nahant.
1 Nantucket.
10 Natick.
11 Needham.
26 New Ashford.
4 New Bedford.
17 New Braintree.
28 New Marlborough.
20 New Salem.
12 Newbury.
12 Newburyport.
11 Newton.
9 Norfolk.
26 North Adams.
13 North Andover.
9 N. Attleborough.
17 North Brookfield.
14 North Reading.
24 Northampton.
16 Northborcugh.
16 Northbridge.
25 Northfield.
5 Norton.
8 Norwell.
9 Norwood.
2 Oak Bluffs.
17 Oakham.
19 Orange.
3 Orleans.
28 Otis.
16 Oxford.
21 Palmer.
17 Paxton.
14 Peabody.
20 Pelham.
7 Pembroke.
15 Pepperell.
27 Peru.
20 Petersham.
19 Phillipston.
27 Pittsfield.
25 Plainfield.
9 Plainville.
6 Plymouth.
7 Plympton.
20 Prescott.
18 Princeton.
3 Provincetown.
8 Quincy.
8 Randolph.
5 Raynham.
14 Reading.
5 Rehoboth.
14 Revere.
27 Richmond.
4 Rochester.
8 Rockland.
12 Rockport.
26 Rowe.
12 Rowley.
19 Royalston.
23 Russell.
17 Rutland.
14 Salem.
13 Salisbury.
28 Sandisfield.
3 Sandwich.
14 Saugus.
26 Savoy.
8 Scituate.
5 Seekonk.
9 Sharon.
28 Sheffield.
25 Shelburne.
10 Sherborn.
15 Shirley.
16 Shrewsbury.
20 Shutesbury.
5 Somerset.
11 Somerville.
22 South Hadley.
24 Southampton.
10 Southborough.
21 Southbridge.
23 Southwick.
17 Spencer.
22 Springfield.
18 Sterling.
28 Stockbridge.
14 Stoneham.
9 Stoughton.
15 Stow.
21 Sturbridge.
10 Sudbury.
25 Sunderland.
16 Sutton.
14 Swampscott.
5 Swansea.
5 Taunton.
19 Templeton.
13 Tewksbury.
2 Tisbury.
23 Tolland.
14 Topsfield.
18 Townsend.
3 Truro.
15 Tyngsborough.
28 Tyringham.
16 Upton.
16 Uxbridge.
14 Wakefield.
21 Wales.
9 Walpole.
10 Waltham.
20 Ware.
6 Wareham.
21 Warren.
19 Warwick.
27 Washington.
11 Watertown.
10 Wayland.
16 Webster.
10 Wellesley.
3 Wellfleet.
19 Wendell.
12 Wenham.
17 West Boylston.
7 West Bridgewater.
21 West Brookfield.
12 West Newbury.
22 West Springfield.
28 West Stockbridge.
2 West Tisbury.
16 Westborough.
23 Westfield.
15 Westford.
24 Westhampton.
18 Westminster.
10 Weston.
4 Westport.
9 Westwood.
8 Weymouth.
25 Whately.
7 Whitman.
22 Wilbraham.
24 Williamsburg.
26 Williamstown.
13 Wilmington.
19 Winchendon.
14 Winchester.
27 Windsor.
11 Winthrop.
14 Woburn.
17 Worcester.
24 Worthington.
9 Wrentham.
3 Yarmouth.

List of Cities and Towns included in Each District assigned to Deputy Fish and Game Commissioners.

DISTRICT NO. 1.

Deputy WILLIAM H. JONES, Nantucket.
Telephone, 24-32.

Nantucket.

DISTRICT NO. 2.

Deputy CHARLES L. SAVERY, Vineyard Haven.
Telephone.

Deputy ALLAN KENISTON, Edgartown.
Telephone, 6-21.

Chilmark.	Gay Head.	Tisbury.
Edgartown.	Gosnold.	West Tisbury.
Falmouth.	Oak Bluffs.	

DISTRICT NO. 3.

Deputy EVERETT B. MECARTA, Harwich.
Telephone, 36-4.

Barnstable.	Eastham.	Sandwich.
Bourne.	Harwich.	Truro.
Brewster.	Mashpee.	Wellfleet.
Chatham.	Orleans.	Yarmouth.
Dennis.	Provincetown.	

DISTRICT NO. 4.

Deputy SAMUEL J. LOWE, New Bedford.
Telephone, 761-2.

Acushnet.	Freetown.	New Bedford.
Dartmouth.	Marion.	Rochester.
Fairhaven.	Mattapoisett.	Westport.

DISTRICT NO. 5.

Deputy ALLEN A. DAVID, TAUNTON.
Telephone, 966-1.

Attleborough.	Norton.	Somerset.
Berkley.	Raynham.	Swansea.
Dighton.	Rehoboth.	Taunton.
Fall River.	Seekonk.	

DISTRICT NO. 6.

Deputy NATHAN W. PRATT, Middleborough.
Telephone, 153-4.

Carver.	Middleborough.	Wareham.
Lakeville.	Plymouth.	

DISTRICT NO. 7.

Deputy CHARLES E. TRIBOU, Brockton.
Telephone, 2101.

Avon.	Easton.	Plympton.
Bridgewater.	Halifax.	West Bridgewater.
Brockton.	Hanson.	Whitman.
Duxbury.	Kingston.	
East Bridgewater.	Pembroke.	

District No. 8.

Deputy.
Telephone.

Abington.
Braintree.
Cohasset.
Hanover.
Hingham.
Holbrook.
Hull.
Marshfield.
Norwell.
Quincy.
Randolph.
Rockland.
Scituate.
Weymouth.

District No. 9.

Deputy William H. Leonard, East Foxborough.
Telephone, Foxborough 9-4.

Bellingham.
Canton.
Foxborough.
Franklin.
Mansfield.
Medfield.
Medway.
Millis.
Norfolk.
North Attleborough.
Norwood.
Plainville.
Sharon.
Stoughton.
Walpole.
Westwood.
Wrentham.

District No. 10.

Deputy James E. Bemis, South Framingham.
Telephone, 564-J.

Ashland.
Berlin.
Dover.
Framingham.
Holliston.
Hopkinton.
Hudson.
Lincoln.
Marlborough.
Milford.
Natick.
Sherborn.
Southborough.
Sudbury.
Waltham.
Wayland.
Wellesley.
Weston.

District No. 11.

Deputy Frederick W. Goodwin, East Boston.
Telephone, East Boston 515-2.

Arlington.
Belmont.
Boston.
Brookline.
Cambridge.
Chelsea.
Dedham.
Everett.
Hyde Park.
Milton.
Needham.
Newton.
Somerville.
Watertown.
Winthrop.

District No. 12.

Deputy Carl E. Grant, Essex.
Telephone, 1-3.

Beverly.
Essex.
Georgetown.
Gloucester.
Hamilton.
Ipswich.
Manchester.
Newbury.
Newburyport.
Rockport.
Rowley.
Wenham.
West Newbury.

District No. 13.

Deputy Walter A. Larkin, Andover.
Telephone, Andover 32-12.

Amesbury.
Andover.
Bedford.
Billerica.
Boxford.
Burlington.
Dracut.
Groveland.
Haverhill.
Lawrence.
Lowell.
Merrimac.
Methuen.
North Andover.
Salisbury.
Tewksbury.
Wilmington.

District No. 14.

Deputy Thomas L. Burney, Lynn.
Telephone, 1983-3.

Danvers.
Lexington.
Lynn.
Lynnfield.
Malden.
Marblehead.
Medford.
Melrose.
Middleton.
Nahant.
North Reading.
Peabody.
Reading.
Revere.
Salem.
Saugus.
Stoneham.
Swampscott.
Topsfield.
Wakefield.
Winchester.
Woburn.

District No. 15.

Deputy James I. Mills, Ayer.
Telephone, 51-2.

Acton.
Ayer.
Bolton.
Boxborough.
Carlisle.
Chelmsford.
Concord.
Dunstable.
Groton.
Harvard.
Littleton.
Maynard.
Pepperell.
Shirley.
Stow.
Tyngsborough.
Westford.

District No. 16.

Deputy George H. Brown, Millbury.
Telephone, 26-13.

Blackstone.
Douglas.
Grafton.
Hopedale.
Mendon.
Millbury.
Northborough.
Northbridge.
Oxford.
Shrewsbury.
Sutton.
Upton.
Uxbridge.
Webster.
Westborough.

District No. 17.

Deputy A. D. Putnam, Spencer.
Telephone, 75-4 or 75-6.

Auburn.
Boylston.
Brookfield.
Clinton.
Holden.
Leicester.
New Braintree.
North Brookfield.
Oakham.
Paxton.
Rutland.
Spencer.
West Boylston.
Worcester.

District No. 18.

Deputy Irving O. Converse, Fitchburg.
Telephone, 269-1.

Ashby.
Ashburnham.
Fitchburg.
Lancaster.
Leominster.
Lunenburg.
Princeton.
Sterling.
Townsend.
Westminster.

District No. 19.

Deputy Albert L. Stratton, Athol.
Telephone, 24-O.

Athol.
Erving.
Gardner.
Hubbardston.
Orange.
Phillipston.
Royalston.
Templeton.
Warwick.
Wendell.
Winchendon.

DISTRICT NO. 20.

Deputy DENNIS F. SHEA, Ware.
Telephone, 132.

Barre.	Greenwich.	Petersham.
Belchertown.	Hardwick.	Prescott.
Dana.	New Salem.	Shutesbury.
Enfield.	Pelham.	Ware.

DISTRICT NO. 21.

Deputy JOHN F. LUMAN, Palmer.
Telephone, 17-5.

Brimfield.	Monson.	Wales.
Charlton.	Palmer.	Warren.
Dudley.	Southbridge.	West Brookfield.
Holland.	Sturbridge.	

DISTRICT NO. 22.

Deputy JAMES P. HATCH, Springfield.
Telephone, 2458-1.

Agawam.	Hadley.	South Hadley.
Amherst.	Hampden.	Springfield.
Chicopee.	Holyoke.	West Springfield.
East Longmeadow.	Longmeadow.	Wilbraham.
Granby.	Ludlow.	

DISTRICT NO. 23.

Deputy CHARLES H. GEHLE, Westfield.
Telephone, 843 or 920.

Blandford.	Middlefield.	Southwick.
Chester.	Montgomery.	Tolland.
Granville.	Russell.	Westfield.
Huntington.		

DISTRICT NO. 24.

Deputy.
Telephone.

Chesterfield.	Hatfield.	Williamsburg.
Cummington.	Northampton.	Worthington.
Easthampton.	Southampton.	
Goshen.	Westhampton.	

DISTRICT NO. 25.

Deputy LYMAN E. RUBERG, Greenfield.
Telephone, 585.

Ashfield.	Gill.	Plainfield.
Bernardston.	Greenfield.	Shelburne.
Buckland.	Leverett.	Sunderland.
Colrain.	Leyden.	Whately.
Conway.	Montague.	
Deerfield.	Northfield.	

District No. 26.

Deputy Arthur M. Nichols, North Adams.
Telephone, 537-2.

Adams.	Hawley.	Rowe.
Charlemont.	Heath.	Savoy.
Cheshire.	Monroe.	Williamstown.
Clarksburg.	New Ashford.	
Florida.	North Adams.	

District No. 27.

Deputy Fred R. Zeigler, Pittsfield.
Telephone, 362-11.

Becket.	Lanesborough.	Washington.
Dalton.	Peru.	Windsor.
Hancock.	Pittsfield.	
Hinsdale.	Richmond.	

District No. 28.

Deputy William W. Sargood, Lee.
Telephone, 119-24.

Alford.	Monterey.	Sheffield.
Egremont.	Mount Washington.	Stockbridge.
Great Barrington.	New Marlborough.	Tyringham.
Lee.	Otis.	West Stockbridge.
Lenox.	Sandisfield.	

[B.]

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Hugh M. Smith, Deputy Commissioner.
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H. F. Moore, Assistant in Charge of Division of Inquiry respecting Food Fishes.
Barton W. Everman, Chief of Division of Alaska Fisheries.
A. B. Alexander, Assistant in Charge of Division of Statistics and Methods of the Fisheries.
Hector Von Bayer, Architect and Engineer.

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S. P. Bartlett, Quincy, Ill.
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G. W. U. Brown, Homer, Minn.
W. O. Buck, Neosho, Mo.
J. L. Leary, San Marcos, Tex.

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Henry O'Malley, Clackamas, Ore.
A. H. Dinsmore, Baker Lake, Wash.
W. K. Hancock, Yes Bay, Alaska.
S. G. Worth, Mammoth Spring, Ark.
C. P. Henkle, Afognak, Alaska.
R. E. Coker, Fairport, Ia.
W. W. Thayer, Northville, Mich.
Claudius Wollich, at large.

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Game and Fish Commissioner.

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Arizona.

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V. V. Merino, ... Flagstaff.
Theo. T. Swift, ... Safford.

California.

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Colorado.

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Idaho.

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Sea and Shore Fisheries.

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State Game Warden.

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Minnesota.

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Mississippi.

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W. J. Gex,	Bay St. Louis.
K. L. Thornton,	Pass Christian.
Richard Mendes,	Bay St. Louis.
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Missouri.

Fish Commissioners.

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Jesse A. Tolerton,	Jefferson City.

Montana.

State Game and Fish Warden.

Henry Avare,	Helena.
D. H. Morgan, Chief Deputy,	Helena.

Nebraska.

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H. N. Miller, Chief Deputy, ...	Lincoln.
W. J. O'Brien, Superintendent of Hatcheries, .	Gretna.
W. A. Huff, Deputy Warden, ...	Superior.
W. D. Clarkson, Deputy Warden, . . .	Valentine.
R. Hyers, Deputy Warden, ...	Lincoln.

Nevada.

Fish Commission.

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E. B. Yerington, ...	Carson.
James Clark, ...	Reno.

New Hampshire.

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Charles B. Clarke, ...	Concord.
Frank P. Brown, ...	Whitefield.

New Jersey.

Fish and Game Commissioners.

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Percival Chrystie, ...	High Bridge.
Ernest Napier, ...	East Orange.
Walter H. Fell, Secretary, ...	Trenton.

New Mexico.

Game and Fish Warden.

Thomas P. Gable, Territorial Game and Fish Warden, ...	Santa Fé.
Willi G. Fischer, Chief Deputy Game and Fish Warden, ...	Santa Fé.

New York.

Conservation Commission.

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James W. Fleming, Commissioner.
John D. Moore, Commissioner.
Albert E. Hoyt, Secretary.
John J. Farrell, Assistant Secretary.

Division of Fish and Game.

Llewellyn Legge, Chief Protector.
Dr. Tarleton H. Bean, State Fish Culturist.
Office, State Capitol, Albany, N. Y.

Bureau of Marine Fisheries.

Robert A. Widenmann, Superintendent.
Charles Wyeth, Assistant Engineer.
Office, 1 Madison Avenue, New York, N. Y.

North Carolina.

Dr. R. H. Lewis, ...	Raleigh.
P. D. Gold, Jr., ...	Raleigh.

North Dakota.

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J. L. Killion, Vice-President, ...	Towner.
D. I. Armstrong, Secretary, ...	Willow City.
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Thomas Griffiths, ...	Grand Forks.
W. N. Smith, Chief Game Warden, District No. 1,	Grafton.
Olaf Bjorke, Chief Game Warden, District No. 2,	Abercrombie.

Ohio.

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Thomas B. Paxton, ...	Cincinnati.
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Walter C. Staley, ...	Dayton.
Gen. John C. Speaks, Chief Warden, . . .	Columbus.
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Oklahoma.

State Game and Fish Warden.

John B. Doolin, State Game and Fish Warden, .	Oklahoma City.
Don B. Lawhead, Secretary, ...	Oklahoma City.

Oregon.

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J. F. Hughes, Secretary,	Salem.
C. F. Stone,	Klamath Falls.
M. J. Kinney,	Portland.
G. H. Kelly,	Eugene.

Master Fish Warden.

R. E. Clanton,	Portland.

State Game Warden.

William L. Finley,	Portland.

Pennsylvania.

Department of Fisheries.

N. R. Buller, Commissioner of Fisheries,	Harrisburg.

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John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
John C. Ogden,	Johnston.
W. A. Leisenring,	Mauch Chunk.

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C. K. Sober,	Lewisburg.
John M. Phillips,	Pittsburg.
Arthur Chapman,	Doylestown.
William B. McCaleb,	Harrisburg.
Lanning Harvey,	Wilkes-Barre.
Dr. Joseph Kalbfus, Secretary,	Harrisburg.

Rhode Island.

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William H. Boardman, Vice-President,	Central Falls.
Adelbert D. Roberts, Auditor,	Woonsocket.
Isaac H. Clarke, Treasurer,	Jamestown.
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William P. Morton, Secretary,	Providence.

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John H. Northup, ... Apponaug.
Edward Atchison, ... Slatersville.
Samuel F. Bowden, ... Barrington.
John G. Wilcox, ... Westerly.

Commissioners of Birds.

C. E. Pierce, Chairman, ... East Providence.
W. Gordon Reed, 2d, ... Providence.
Edward R. Lewis, M.D., ... Westerly.
W. H. Thayer, ... Bristol.
C. M. Highes, ... Newport.

TENNESSEE.

State Warden.

Joseph H. Acklen, ... Nashville.

TEXAS.

Game, Fish and Oyster Commission.

R. H. Wood, ... Rockport.

UTAH.

Fish and Game Department.

Fred W. Chambers, Commissioner, ... Salt Lake City.

VERMONT.

John W. Titcomb, ... Lyndonville.

VIRGINIA.

Commission of Fisheries.

W. McDonald Lee, Commissioner, ... Irvington.
S. Wilkins Matthews, Secretary, ... Oak Hall.
George B. Keezell, ... Keezeltown.
Bland Massie, ... Tyro.
J. M. Hooker, ... Stuart.
Edward L. C. Scott, Clerk, ... Richmond.

WASHINGTON.

Department of Fisheries and Game.

John L. Riseland, State Commissioner and Game
Warden, ... Bellingham.

West Virginia.

Forest, Game and Fish Warden.

J. A. Viquesney, Warden, ... Belington.
W. B. Rector, Chief Deputy, ... Belington.
H. M. Lockridge, Chief Deputy, ... Belington.

Wisconsin.

Commissioners of Fisheries.

The Governor, ex-officio.
Jabe Alford, President, ... Madison.
A. L. Osborn, Vice-President, ... Oshkosh.
E. A. Birge, Secretary, ... Madison.
B. C. Wolters, ... Appleton.
James O. Davidson, ... Madison.
George W. Peck, ... Milwaukee.
John C. Burns, ... LaCrosse.
James Nevin, ... Madison.

State Game and Fish Warden.

John A. Sholts, ... Madison.

Wyoming.

State Game Warden.

D. F. Hudson, ... Lander.

CANADA.

Alberta.

Department of Agriculture.

Duncan Marshall, Minister, ... Edmonton.
George Harcourt, Deputy Minister, . . . Edmonton.
Benjamin Lawton, Chief Game Guardian, . . Edmonton.

British Columbia.

Provincial Game and Forest Warden.

A. Bryan Williams, ... Vancouver.

Manitoba.

Department of Agriculture and Immigration.

R. P. Roblin, Minister, ... Winnipeg.
Charles Barber, Chief Game Guardian, . . Winnipeg.

New Brunswick.

Crown Land Department.

W. C. H. Grimmer, Surveyor-General, . .	St. Stephen.
T. G. Loggie, Deputy Surveyor-General, . .	Fredericton.
Dennis Doyle, Chief Fishery, Game and Fire Warden, District 1, ...	Newcastle.
A. E. O'Leary, Chief Fishery, Game and Fire Warden, District 2, ...	Richibucto.
W. J. Dean, Chief Fishery, Game and Fire Warden, District 3, ...	Musquash.
John McGibbon, Chief Fishery, Game and Fire Warden, District 4, ...	St. Stephen.
S. U. McCully, Overseer of fisheries, . . .	Chathamport.

Newfoundland.

Department of Marine and Fisheries.

A. W. Piccott, President, Minister of Marine and Fisheries, ...	St. Johns.
Alex. J. W. McNelly, Vice-President, . . .	St. Johns.
Dr. L. E. Keegan, First Assistant Vice-President,	St. Johns.
Thomas Winter, Second Assistant Vice-President,	St. Johns.
James W. Mercer, Secretary, ...	St. Johns.

Nova Scotia.

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J. A. Knight, K.C., Chief Game Commissioner, .	Halifax.
A. O. Pritchard, Associate Commissioner, . .	New Glasgow.
C. R. Kelley, Associate Commissioner, . .	Yarmouth.

Ontario.

Department of Public Works (Game and Fisheries Branch).

J. O. Reaume, Minister, ...	Toronto.
E. Tinsley, Superintendent of Game and Fisheries, ...	Toronto.
Kelly Evans, Commissioner, ...	Toronto.

Prince Edward Island.

Game Inspector.

E. T. Carbonell, ...	Charlottetown.

Quebec.

Department of Colonization, Mines and Fisheries (Fisheries and Game Branch).

Charles Devlin, Minister, ...	Quebec.
J. Dufault, Deputy Minister, ...	Quebec.
E. T. D. Chambers, Special (Expert) Officer, .	Quebec.
Hector Caron, General Superintendent of Fisheries and Game, ...	Quebec.
Eug. Hamel, Assistant Superintendent of Fisheries and Game, ...	Quebec.
J. A. Bellisle, General Inspector of Fisheries and Game, ...	Quebec.

Saskatchewan.

Department of Agriculture.

W. M. Motherwell, Minister of Agriculture, .	Regina.
A. F. Mantle, Deputy Minister, ...	Regina.
————, Chief Game Guardian, . . .	Regina.

[C.]

Distribution of Food Fish.

Trout Fry.

Distribution of Trout Fry from the Adams Hatchery during April and May, 1911.

Applicant.	Town.	Name of Brook.	Number.
Robert Kent,	Pittsfield,	Kent,	5,000
C. R. St. James,	Pittsfield,	Yokum,	5,000
Geo. S. Baker,	Pittsfield,	Schoolhouse,	5,000
J. M. Burns,	Pittsfield,	Shaker,	5,000
Arthur L. Morse,	Lanesborough,	Sechum,	5,000
J. D. Shearer,	Lanesborough,	Rice,	5,000
Harry B. Sees,	Pittsfield,	Smith,	5,000
E. J. Spall,	Lenox,	Roaring,	5,000
Stacey Oliver,	Pittsfield,	Allen,	5,000
Frank Hempstead,	Pittsfield,	Jacoby,	5,000
Carl Wurtzbach,	Tyringham,	Hop,	5,000
Pliny D. Hunt,	Tyringham,	Cooper,	5,000
C. A. Campbell,	Lee,	Greenwater,	5,000
W. J. Ingram,	South Lee,	Beartown,	5,000
Elmer S. Moat,	Lee,	Washington Mountain,	5,000
John H. Daley,	Tyringham,	Tyringham,	5,000
Charles D. Hawks,	West Becket,	Soule,	5,000
W. H. Spear,	State Line,	Van Deusen and Alford,	5,000
Geo. Blood,	State Line,	Van Deusen and Alford,	5,000
Alfred H. Wingett,	Lenox,	Dunbar,	10,000
Alfred H. Wingett,	Lenox,	West,	10,000
Samuel Newell,	Great Barrington,	Alford,	5,000
H. W. Scott,	–	– – –	5,000
Dr. A. L. Bourdreau,	Becket,	Coal,	10,000
Harry J. Sheldon,	Adams,	Mason,	10,000
W. P. Martin,	Cheshire,	Bassett,	10,000
Harry J. Stetson,	Plainfield,	West Mountain,	10,000
H. J. Coughlin,	Clarksburg,	Hudson, North Branch,	10,000
H. J. Coughlin,	North Adams,	Tunnell, Paul,	10,000
W. H. Thatcher,	North Adams,	Sherman,	5,000
Frederick Spencer,	Buckland,	Clark,	5,000
Geo. R. Adams,	Buckland,	Clark,	5,000
Chester D. Stiles,	Sunderland,	Welsh,	5,000
Chester D. Stiles,	Whately,	Glen,	5,000
R. L. Clapp,	Montague,	Pond,	5,000
Porter Farwell,	Montague,	Tributary to Sawmill River,	5,000
A. G. Moody,	Northfield,	Pauchaug,	5,000
H. J. Sheldon,	Adams,	Bassett,	10,000
			235,000

Fry distributed from the Sutton Hatchery during April and May, 1911.

Valentine F. Skiff, Charles F. Bowers, Jas. M. Greene, Geo. F. Searle, Charles Best, Leon H. Bowers, Wm. T. Smith, Geo. F. Gehle, John M. Sauter, J. H. Jones, L. C. Coburn, Wm. H. Barnes,	Westfield,	Fowler, Timber Swamp, Jack's,	48,000

Fry distributed from the Sutton Hatchery, etc. — Concluded.

Applicant.	Town.	Name of Brook.	Number.
John J. Connelly,	Webster,	Sucker, Potash,	12,000
A. D. Norcross,	Monson,	Conant,	8,000
Henry E. Dean,	Worcester,	Lincoln and Beaver,	4,000
L. W. West,	Hadley,	Hartsbrook,	4,000
J. A. Miller,	Easthampton,	Sawmill,	4,000
D. Scott Low,	Easthampton,	North branch Manhan River,	4,000
W. L. Pitcher,	Easthampton,	Bassett,	4,000
Edwin W. Lawton,	Hardwick,	Newton,	4,000
S. W. Coe,	Hardwick,	Elwell,	4,000
Henry H. Hallock,	Hubbardston,	Tanyard,	4,000
Wm. J. Shaffer,	Hubbardston,	Mareau,	4,000
H. G. Howard,	Ashburnham,	Cooper,	4,000
Frank L. Hardy,	North Ashburnham,	Cooper,	4,000
Chas. A. Merrill,	Winchendon,	Belknap,	4,000
Wm. E. Davis,	Winchendon,	Belknap,	4,000
W. M. Baker,	New Salem,	Bullard,	4,000
Chester A. Hinds,	New Salem,	Mill,	4,000
Arthur W. Stevens,	Athol,	Popple Camp,	4,000
Jas. W. Boutell,	Athol,	Riceville,	4,000
D. C. Warren,	Athol,	Ellinwood,	4,000
H. S. Stoddard,	Athol,	Oliver,	4,000
Burt C. Brown,	Athol,	Nelson,	4,000
Burton W. Streeter, Jr.,	Athol,	West,	4,000
Geo. H. Dodge,	New Salem,	Bosworth,	4,000
Claude R. Edgerly,	Royalston,	Nancy Whipple,	4,000
Joseph Hamel,	Royalston,	Greeley,	4,000
Harry A. Bancroft,	Athol,	Newton,	4,000
F. S. Casavant,	Gardner,	Bailey,	4,000
E. L. Knowlton,	Gardner,	Poor Farm,	4,000
Frank E. Streeter,	Hubbardston,	Hosmer,	4,000
W. A. Streeter,	Westminster,	Marrow Meadow,	4,000
A. W. Pratt,	Gardner,	Mosquito,	4,000
Chas. N. Dyer,	Hubbardston,	Hubbardston,	4,000
Leominster Sportsman's Association,	Leominster,	Lines, Wickepickee, Fall, Lunenburg, Clissell, Fort Pond,	24,000
Henry L. Pierce,	Barre,	Prince River,	4,000
Chas. G. Allen,	Barre,	Cemetery,	4,000
Rev. C. H. Smith,	Barre,	Bemis and Moose,	4,000
Geo. H. Miner,	Barre,	Pratt,	4,000
A. G. Chickering,	Lancaster,	Ponakin,	4,000
Clinton Gun Club,	Berlin,	Berlin,	20,000
	Bolton,	Fairbanks,	
	Harvard,	Harvard,	
	Clinton,	Clamshell Pond,	
Richard L. Everitt,	Wellesley,	Indian Spring,	4,000
Chas. S. Chase,	Dighton,	Segregansett River,	4,000
Jos. Rudolph,	Taunton,	Segregansett River,	4,000
Jos. Rudolph,	Lakeville,	Poquoy,	4,000
J. J. Kennedy,	Stoughton,	Dead Meadow,	4,000
Wm. M. Marden,	North Hanson,	Bretts,	4,000
W. Scott Edson,	Scituate,	Beaver Dam Stream,	4,000
Clarence P. Abbott,	Groveland,	Brown,	4,000
Robt. W. Briggs,	Amesbury,	Attitash,	4,000
Geo. T. Wendell,	Amesbury,	Amesbury,	4,000
H. E. Richardson,	Westford,	Snake Meadow,	4,000
D. F. McIntosh,	Woburn,	Shaker Glen,	4,000
C. E. Taylor,	Woburn,	Blanchard,	4,000
R. H. Magee,	Woburn,	Cutter,	4,000
Wm. R. Taylor,	Westford,	Tadmuck,	4,000
Edward M. Abbott,	Littleton,	Creesy,	4,000
Chas. F. Nourse,	Lexington,	Vine, North Lexington,	12,000
I. Pfeiffer, Jr.,	Bedford,	Shawsheen River,	8,000
Chas. L. Hopson,	Falmouth,	Lake Leman,	4,000
Fitchburg Sportsman's Club,	Fitchburg,	Mulpus,	4,000
	Ashburnham,	Adams,	4,000
	Lunenburg,	Laws,	4,000
			356,000

Brown Trout Fry distributed during April and May, 1911.

Applicant.	Town.	Name of Brook.	Number.
Fitchburg Sportsman's Club,	Lunenburg,	Catacummaug,	15,000
	Lunenburg,	Mulpus,	15,000
A. D. Putnam,	North Spencer,	Ludden,	15,000
Harry S. Tripp,	North Spencer,	Bemis,	15,000
Fish and Game Commissioners,	Ashland,	Poor Farm,	15,000
	Wellesley,	Fuller,	10,000
	Needham,	Tun,	10,000
	Newton,	Farm,	10,000
			105,000

Fingerling Trout distributed in October and November, 1911.

Arthur L. Morse, Robert T. Kent, C. R. St. James, J. D. Shearer, E. J. Spall, Harry B. Sees, Geo. S. Baker, Frank Hempstead, Stacy Oliver, J. M. Burns,	Pittsfield,	Wells, Brewery, Schoolhouse,	5,000
David J. Gunlich,	Pittsfield,	Colt,	500
John H. Daley,	Tyringham,	Hop,	500
Carl Wurtzbach,	Tyringham,	Hop,	500
C. D. Hawks,	Tyringham,	Hop,	500
Elmer S. Moat,	Lee,	Washington Mountain,	500
Pliny D. Hunt,	West Becket,	Coopers,	500
W. J. Ingram,	South Lee,	Mountain,	500
D. A. Campbell,	Lee,	Greenwater,	500
J. M. Van Huyck,	Lee,	Perkins,	500
M. J. Kelly,	Tyringham,	Hop,	500
Alfred H. Wingett,	Lenox,	West, North,	1,000
Dr. F. L. Smith,	South Egremont,	Dalzell,	500
Eugene Fuller,	South Egremont,	Goodale,	500
O. C. Bidwell,	Monterey,	Harmon,	500
Earl M. Baldwin,	West Stockbridge,	Van Dusen,	500
A. Silvernail,	State Line,	Watsons,	500
W. H. Spear,	State Line,	Mack,	500
Jas. F. Kelly,	Washington,	Cold and Molto,	500
P. H. Clarisey, Thos. J. Bolton, R. F. Pender, John Dwyer, D. Herbert Pike,	Windsor and Dalton,	Cleveland, Waconah, Kitteridge,	2,500
O. C. Bidwell,	Monterey,	Harmon,	500
Edw. L. Douglass, G. W. Pettibone, Frederick M. Brown, Valentine F. Skiff, L. C. Coburn,	Westfield,	Powder Mill, Jacks, White,	3,000
Edw. G. Clark, W. S. Marsh, John M. Sauter, Robert Scheip, James M. Greene, Chas. F. Bowers, W. A. Flouton,	Westfield,	Powder Mill, Jack's, White,	3,000
F. L. Hargreaves,	North Adams,	South branch Hoosac River,	500
Philip D. Powers,	Adams,	Tophet,	500
Robert Cutter,	North Adams,	Cascade,	500
W. B. Nary,	Adams,	Morey Farm,	500
Bradley C. Newell,	Rowe,	Newell Farm,	500
Charles Hunt,	Rowe,	Hunt,	500
L. J. Brown,	Rowe,	Brown,	500
Horace B. Brown,	Florida,	Cold River,	500
John F. Hood,	Gill,	Fall River,	500
Daniel Whitmore,	North Sunderland,	Slate Rock,	500

Fingerling Trout distributed in October and November, 1911 — Continued.

Applicant.	Town.	Name of Brook.	Number.
Alfred S. Crane,	Middlefield,	Factory,	500
Hartley B. Buxton,	Middlefield,	Tuttle,	500
Chas. H. Ferris, Dr. A. L. Boudreau,	Middlefield,	Cole,	1,000
Harry Hill,	Northampton,	Mosquito Hollow,	500
John J. Hanfield,	Williamsburg,	Mill River,	250
F. A. Shumway,	Williamsburg,	Bradford,	250
Frank A. Brooks,	Williamsburg,	Ashfield Stream,	250
Wells G. Bisbee,	Williamsburg,	Bullard,	250
Fred W. Upton,	Williamsburg,	Ashfield Stream,	250
A. J. Polmatier,	Williamsburg,	Mill River,	250
Leland W. Godfrey,	Goshen,	Hampshire,	500
John Doherty,	Goshen,	Packard,	500
W. A. Smith,	Goshen,	Highland,	500
M. W. Smith,	Goshen,	Rogers,	500
W. H. Douglas,	Barre,	Prince River,	500
Henry L. Pierce,	Barre,	Cemetery,	500
Rev. C. H. Smith,	Barre,	Moose,	500
John Corsa, Paul C. Phillips, M. L. Graves, A. T. Mitten,	Pelham,	Swift River,	2,000
Carl Spofford,	Sudbury,	Cold,	500
W. R. Rowe,	Sudbury,	Cold,	500
E. J. Hoffses,	Sudbury,	Cold,	500
C. H. Hall, Michael H. Sullivan, Frank H. Mackey, Jas. M. Hurley, John V. O'Brien,	Marlborough,	Bartlett, Flag, Fort Meadow, Millham,	2,500
Chas. N. Hargraves,	Framingham,	Sucker and Rattlesnake,	500
Thos. Taylor,	Westport,	Bread and Cheese,	500
James Burke,	South Westport,	Cornell,	500
Robert C. B. Burrell,	Westport,	Shingle Island,	500
Chas. P. Whitters,	Lakeville,	Cedar Swamp,	500
William Wilson,	Lakeville,	Holloway,	500
T. W. Tisdale,	Lakeville,	Holloway,	500
Roland M. Keith,	Bridgewater,	Jolly,	500
Capt. Fred Leizleton,	Brockton,	Beaver,	500
Arthur B. Murdock,	Brockton,	Trout,	500
Jas. F. Sheridan,	Blackstone,	Fox,	250
Jas. B. Hodder,	Blackstone,	Fox,	250
Irving J. Johnson,	Oxford,	Potter,	500
David N. Taft,	Oxford,	Potter,	500
J. J. Kennedy,	Stoughton,	Dead Meadow,	500
D. H. O'Brien,	Rowley,	Bachelor and Taylor,	500
B. W. Buckley,	Ware,	Flat,	500
D. F. Shear,	Ware,	Flat,	500
D. F. Shear,	Hardwick,	Flat,	1,000
Chas. H. Sawyer,	Sunderland,	Welch,	500
Thos. T. Ahearn,	Sunderland,	Ahearn,	500
Alfred J. Preece,	Northampton,	Running Gutter,	500
Alfred J. Preece,	Northampton,	Broad,	500
Alfred J. Preece,	Northampton,	Roberts Meadow,	500
E. P. Dunpley,	Clarksburg,	Hudson,	500
E. P. Dunpley,	Clarksburg,	North Branch,	500
E. P. Dunpley,	North Adams,	Tunnel,	500
E. P. Dunpley,	North Adams,	Sherman,	500
Edward P. Driscoll,	Windsor,	Tyler,	500
Chester A. Hinds,	North New Salem,	Mill,	500
W. W. Baker,	New Salem,	Bullard,	500
Frank A. Warner,	New Salem,	Poole,	500
Greenfield Sportsman's Club, E. W. Strecker, Secretary,	Greenfield,	Green River, Fall River and branches,	3,000
G. Baxter Read,	Bernardston,	Fall River,	500
A. G. Moody,	Northfield,	Mill and Nelson,	500
A. G. Moody,	Northfield,	Pauchaug and Warwick,	500
A. G. Moody,	Northfield and Bernardston,	Dry and Bennetts,	500
Chester D. Stiles,	Whately,	Glen,	500
Frank L. Hardy,	Ashburnham,	Cooper,	250
H. G. Howard,	Ashburnham,	Cooper,	250
Frank Z. Knight,	Townsend,	Bixby,	500

Fingerling Trout distributed in October and November, 1911 — Continued.

Applicant.	Town.	Name of Brook.	Number.
Frank Z. Knight,	Townsend,	Barberry Hill,	500
John H. Whitcomb,	Harvard,	Shaker,	500
A. G. Chickering,	Bolton,	Bowers,	500
C. H. Sage,	Great Barrington,	Seekonk,	500
Samuel Newell,	Great Barrington,	Alford,	500
Homer E. Foote,	Great Barrington,	Green River,	500
Bart Bossidy,	Lee,	Barnes,	500
John S. Hubbard,	Sturbridge,	Hyland,	500
P. S. Callahan,	Sturbridge,	Bemis,	500
John Day,	Sturbridge,	Bemis,	500
John H. Stockman,	Charlton,	Bond,	500
John H. Stockman,	Charlton,	Aldrich,	500
Arthur W. Ewell,	West Rutland,	Browning,	500
John Macfarlane,	Warren,	White,	500
Joseph O. Faneuf,	West Warren,	Bailey,	500
Joséph S. Klebes,	Attleborough,	Town Farm,	500
F. A. Shiner,	South Franklin,	Woodward,	250
Frank D. Searle,	Norfolk,	Riverside,	250
Edward S. Cook,	Norfolk,	Mann,	250
Dr. Herbert A. Besse,	Norfolk,	Mann,	250
S. Howell Wright,	Norwood,	Germany,	500
Frank B. Twitchell,	Framingham,	Brackett and Nobscot,	500
Basil E. Aldrich,	Hopkinton,	Echo Lake,	500
Basil E. Aldrich,	Milford,	Braggville,	500
Canton Game Protective Association, Benj. E. Morse, Secretary,	Canton,	Pecunit,	500
	Canton Junction,	Ellis,	500
Clark Chase, Jr.,	Swansea,	Milford,	500
John G. Cummings,	Shrewsbury,	Rawson Hill,	500
Henry E. Dean,	Worcester,	Lincoln and Beaver,	500
Michael E. Daley,	Dartmouth,	Lees River,	500
Charles W. Davol,	Rehoboth,	Palmer River,	500
Wayne M. Freeman,	Taunton,	Palmer River,	500
Chas. W. Davol,	Taunton,	Meadow,	500
Joseph Rudolph,	Taunton,	Segregansett,	1,000
Paul J. Franklin,	Dover,	Noanet,	500
Henry Powderly,	Randolph,	Mill,	500
Wm. M. Marden,	North Hanson,	Bretts,	500
Maynard Clemons,	Andover,	Skug River,	500
N. J. Hardy,	Arlington,	Reed,	500
Chas. R. Whytal,	Lexington,	Meadows,	500
Maynard E. S. Clemons,	Wilmington,	Sutton,	500
Ralph H. Holman,	Stoneham,	Clearwater,	500
H. E. Hersam,	Stoneham,	Sweetwater,	500
James Tirrell,	Hingham,	Accord Pond Stream,	250
James Tirrell,	South Weymouth,	Swamp River,	250
Edward Babson,	Gloucester,	Mill,	250
Ralph B. Herrick,	Gloucester,	Mill,	250
Wm. A. Rolfe,	Boxford,	Fish,	500
A. D. A. Gallivan,	Granby,	Stoney,	500
M. J. Murray,	Westhampton,	Manhan River,	500
Herman A. MacDonald,	Beverly,	Beverly Farms and Sawmill,	500
I. Pfeiffer, Jr.,	Bedford,	Shawsheen River and Elm,	1,000
Jas. P. Welsh,	Woodville,	Tom Swamp,	500
A. C. Phipps,	Hopkinton,	Crowly,	500
J. L. Adams,	Haverhill,	Whittier, Parsonage, Millvale, Fitzgerald,	2,500
A. E. Snow,	Springfield,	Watershop Pond,	1,000
C. H. Rivenburg,	Chester,	Sanderson, Stevens,	1,000
Claude R. Edgerly,	Royalston,	Nancy Whipple,	500
Joseph Hamel,	Royalston,	Greely,	500
Burt C. Brown,	Athol,	Nelson,	500
F. L. Hager,	Winchendon,	Carters, Beaman,	1,500
A. R. Paine,	Templeton,	Webber,	500
Wm. A. Hall,	Templeton,	Bourne and Hadley,	500
Robert H. Culdon,	Baldwinville,	Sweenyville,	500
E. L. Knowlton,	Winchendon,	Carter,	500
Dr. A. S. Cleaves,	Westminster,	Mare Meadow,	500
D. H. Gates,	Gardner,	Poor Farm,	500
S. W. Rogers,	Phillipston,	Brigham,	500
E. E. Barthel,	Gardner,	Poor Farm,	500
C. Fred Morse,	Gardner,	Perley,	500
F. J. Piper,	Gardner,	Bailey,	500

Fingerling Trout distributed in October and November, 1911 — Concluded.

Applicant.	Town.	Name of Brook.	Number.
F. L. Gilson,	Gardner,	Hubbardston,	500
Wm. P. Wharton,	Groton,	Hunkerty,	500
Leominster Sportsman's Association,	Leominster,	Wickepickee,	1,500
Fitchburg Sportsman's Club,	Ashby,	Sheldon,	1,500
Chas. T. Brown,	Winchendon,	Wilder,	500
Wm. H. Brown,	Winchendon,	Wilder,	500
A. L. Brown,	Winchendon,	Stockwell,	500
Chas. A. Merrill,	Winchendon,	Stockwell,	500
P. J. Cannon,	Wendell,	Phelps,	500
Willis P. Leonard,	Wendell,	Coolidge,	500
C. M. Porter,	Wendell,	Osgood,	500
M. M. Brown,	Wendell,	Whetstone,	500
Henry H. Hallock,	Hubbardston,	Tanyard,	500
Reginald Washburn,	West Rutland,	Browning,	500
Eugene J. Riordan,	Holden,	Trout,	500
C. C. Dodge,	Shrewsbury,	Bullard,	500
Chas. A. Bowker,	Worcester,	Beaver,	500
Moses Gross,	Worcester,	Beaver,	500
Jas. W. Fernald,	Shrewsbury,	Wyman,	500
Norton Company,	Worcester,	Barbers,	500
Wm. A. Dorman,	Holden,	Trout,	500
H. C. Puffer,	Ludlow,	Higher,	500
Frank A. Doubleday,	Dana,	Blackmer,	500
Geo. W. Durkee,	Dana,	Whitmore,	500
Chas. E. Gee,	Dana,	Blackmer,	1,000
J. A. Miller,	Easthampton,	Bassetts,	500
D. Scott Low,	Easthampton,	Manhan River,	500
Ira J. Humes,	Granby,	Bachelor,	500
Thos. Fitzgerald,	South Hadley Falls,	Stony,	500
John P. Rourke, John Sears, Peter J. Robinson,	Chicopee Falls,	Cooley,	1,500
C. E. Miller,	West Brookfield,	Sucker,	500
Wm. H. Murray,	West Brookfield,	White,	500
Fred N. La Barge,	West Brookfield,	Barrett,	500
Jas. A. Anderson,	West Brookfield,	Bradish,	500
North Brookfield Fish and Game Association,	North Brookfield,	Mad, Morgan, Bigelow, West, Harrington, Snow,	1,500
A. D. Norcross,	Monson,	Sullivan, Conant, Meacham,	1,000
W. A. Cone,	Monson,	Conant,	500
John F. Luman,	Palmer,	Kings, Moores, Quaboag River,	1,500
Clinton Gun Club, W. J. Tedford, Secretary,	Harvard, Bolton, Berlin, Lancaster,	Brackett, Bowers, Dickinson, Collins, Berlin, Clamshell Pond, Carr,	4,000
			132,000

Brown Trout Fingerlings distributed in October and November, 1911.

Metropolitan Park Commission,	Riverside, Waltham, Wellesley, Watertown,	Charles River and tributaries,	21,000

Distribution of Landlocked Smelt Eggs in 1911.

Name of Waters.	Town.	Number.
Smelt Brook,	Kingston,	500,000
First Brook,	Kingston,	500,000
Second Brook,	Kingston,	500,000
Third Brook,	Kingston,	500,000
Soule's Brook,	Kingston,	500,000
Canson's Pond Brook,	Kingston,	500,000
Tussock Brook,	Kingston,	500,000
Back River,	Amesbury,	3,500,000
Mill River,	Essex,	1,500,000
Tributary to Essex River,	Essex,	500,000
Tributary to Little River,	West Gloucester,	500,000
Tributary to Little River,	West Gloucester,	500,000
		10,000,000

Distribution of Adult White Perch in 1911.

Name of Pond.	Town.	Number.
Prospect,	Taunton,	170
Winnecunnett,	Norton,	99
White,	Athol,	114
Whalom,	Lunenburg,	119
Long,	Lakeville,	96
Five-mile,	Springfield,	97
Larnard,	South Framingham,	108
Dennison,	Winchendon,	259
Nine-mile,	Wilbraham,	150
Forge,	Littleton and Westford,	195
Monomonack,	Winchendon,	365
		1,772

Waters stocked without Further Action during 1911.

Name of Waters.	Town.	Adult Brook Trout.	Adult Brown Trout.
Westfield River,	Cummington and Huntington,	118	–
Quaboag River,	West Brimfield,	115	–
Quaboag River,	West Brimfield,	80	–
Town Brook,	Lanesborough,	24	–
Secum Brook,	Lanesborough,	36	–
Jacoby Brook,	Pittsfield,	21	–
Wahconah Falls Stream,	Dalton,	40	–
Higher Brook,	Ludlow,	–	115
Swift River,	Greenwich,	40	–
– –	North Dana,	–	74
Charles River,	Riverside, etc.,	–	125
		474	314

Ponds stocked in Accordance with Chapter 285, Acts of 1911.

Winnecunnett, Norton.

Massapoag, Sharon.

Forge, Westford and Littleton.

Congamond Lakes, Southwick.

[D.]

Distribution of Pheasants.

Applicant.	Town.	Number.
Charles Wing,	South Westport,	10
Isaac F. Blanchard,	South Westport,	10
Frank B. Greene,	New Bedford,	10
Myron E. Story,	Springfield,	10
E. A. Woodward,	Springfield,	10
Frank D. Searle,	Franklin,	10
F. A. Stubbs,	Medfield,	10
Basil E. Aldrich,	Milford,	10
North Brookfield Fish and Game Association.	North Brookfield,	10
Wm. A. Gaston,	Barre,	10
Wm. W. Sargood,	Lee,	8
Ernest S. Gage,	East Lee,	8
W. J. Ingram,	South Lee,	8
Frank Hempstead,	Pittsfield,	8
Frederick S. Williams,	Lanesborough,	8
A. H. Wingett,	Lenox,	8
Frank J. Whitney,	North Dana,	8
Chas. F. Choate, Jr.,	Petersham,	8
Geo. S. Chapin,	Enfield,	8
John J. Connelly,	Webster,	8
F. Eugene Wallace,	Westborough,	8
John J. Kennedy,	Stoughton,	8
Arthur S. Aborn,	Billerica,	8
Wm. A. Rolfe,	Boxford,	8
Wm. H. Keleher,	Woburn,	8
J. A. Barton,	Fitchburg,	8
F. L. Hager,	Baldwinville,	8
Oliver K. Pierce,	Ayer,	8
F. Z. Knight,	Townsend Harbor,	8
E. M. Richardson,	Whitman,	8
Wendell F. Brown,	North Scituate,	8
Percy F. Wonson,	East Gloucester,	8
Halvor Torgeson,	Plymouth,	8
Henry E. Garfield,	W. Dennis,	8
J. M. Van Huyck,	Lee,	8
C. A. Reynolds,	Manchaug,	8
Henry F. Rice,	Sutton,	8
Henry D. Smith,	Hanover,	8
Roland M. Keith,	Bridgewater,	8
J. H. Schoonmaker,	Ware,	8
Dana Malone,	Greenfield,	8
Cyrus W. Hicks,	Waltham,	8
Elmer A. Macker,	North Grafton,	8

Distribution of Pheasants — Concluded.

Applicant.	Town.	Number.
E. F. Andrews,	Shrewsbury,	8
Jas. F. Purcell,	Lawrence,	8
Henry Boynton,	Lowell,	8
Jonathan H. Jones,	Waquoit,	8
Arthur W. Ewell,	West Rutland,	8
Henry E. Dean,	Worcester,	8
John F. Russell,	Greenfield,	8
John S. Appleton,	Nantucket,	8
Albert H. Lewis,	North Dartmouth,	8
Barry M. Simpson,	Lowell,	8
Geo. Foulsham,	Lee,	17
Horatio A. Lamb,	Mattapan,	16
Benj. W. Stanley,	Gloucester,	16
E. P. Bartlett,	Amherst,	24
Wm. B. Eaton,	Middleton,	8
Bart Bossidy,	Tyringham,	8
E. J. Norman,	Lee,	8
H. T. Moulton,	Monson,	8
T. S. Johnson,	Dana,	8
Reginald Washburn,	West Rutland,	8
Horatio A. Lamb,	Mattapan,	4
W. M. Peck,	Wales,	8
Edward H. Lathrop,	Huntington,	10
Douglas B. Wesson,	Tolland,	10
David D. Kelley,	South Yarmouth,	8
Wm. Jackman,	Gloucester,	8
H. O. Wood,	Swansea,	6
F. S. Simmons,	Somerset,	6
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[E.]

Arrests and Convictions.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

State v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Jose Lima,	New Bedford,	Taking shellfish in violation of section 114, chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and chapter 177, Acts of 1910.	Convicted,	$10 00	
Philip Cormier,	New Bedford,		Convicted,	10 00	
Daniel P. Small,	Harwich,		Discharged,	–	
Arthur F. Nickerson,	Harwich,		Discharged,	–	
John Soares,	New Bedford,		Convicted,	–	Filed.
Manuel Sylvia,	New Bedford,		Convicted,	10 00	
James Burke,	New Bedford,		Convicted,	10 00	
Edward Landry,	New Bedford,		Convicted,	50 00	
Manuel Correia,	New Bedford,		Convicted,	50 00	
Marshall White,	New Bedford,		Convicted,	10 00	
Herbert Hall,	New Bedford,		Convicted,	10 00	Went to jail.
Marianno Luce,	New Bedford,		Convicted,	10 00	
Joseph Martin,	New Bedford,		Convicted,	10 00	
Manuel Parao,	New Bedford,		Convicted,	10 00	
Joseph Parrimello,	Boston,		Convicted,	–	Filed; costs of court, $3.
Joseph Bertoline,	Boston,		Convicted,	–	Filed; costs of court, $3.
Frank Parrimello,	Boston,		Convicted,	–	Filed; costs of court, $3.
Salvatore Favazza,	Boston,		Convicted,	–	Filed; costs of court, $3.
Matteo Favazza,	Boston,		Convicted,	–	Filed; costs of court, $3.
Matteo Palazola,	Boston,		Convicted,	–	Filed; costs of court, $3.
John Mahoney,	South Boston,		Convicted,	–	Filed; costs of court, $3.
Nicola Parisi,	Boston,		Convicted,	–	Filed; costs of court, $3.
Guiseppe Palazola,	Boston,		Convicted,	–	Filed; costs of court, $3.
Vincenzo Frontera,	Boston,		Convicted,	–	Filed; costs of court, $3.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Edward Feeney,	South Boston,	Taking shellfish in violation of section 114, chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and Chapter 177, Acts of 1910,	Convicted,	$5 00	
Patrick Carr,	South Boston,		Convicted,	5 00	
George Hall,	Dorchester,		Convicted,	5 00	
Frank W. Keith,	Malden,		Convicted,	5 00	
Samuel Lovasco,	Boston,		Convicted,	5 00	
Bastiano Lovasco,	Boston,		Convicted,	3 00	Costs of court, $2.
Peter A. Flannery,	East Boston,		Convicted,	5 00	Defaulted at superior court.
Ernest F. Pope,	Roxbury,		Convicted,	5 00	Defaulted at superior court.
Dennis Mahoney,	South Boston,		Convicted,	10 00	Defaulted at superior court.
John J. Mahoney,	South Boston,		Convicted,	10 00	Defaulted at superior court.
Albert Fraser,	East Boston,		Convicted,	3 00	
Peter E. Landry,	East Boston,		Convicted,	5 00	
Sylvester J. McIsaac,	East Boston,		Convicted,	5 00	
Horace J. Craig,	Dorchester,		Convicted,	5 00	
Martin Olsen,	Nantasket,		Convicted,	5 00	
Elmer Olsen,	Nantasket,		Convicted,	5 00	
William Cannon,	East Boston,		Convicted,	5 00	
John Conrad,	Nantasket,		Convicted,	5 00	
Frank H. Ryder,	Quincy,		Convicted,	5 00	
Wm. Greenfield,	East Boston,		Convicted,	5 00	
Rollin H. Fisher,	Dorchester,		Convicted,	3 00	
Robert Mellett,	Atlantic,		Convicted,	3 00	
Thomas Callahan,	Roxbury,		Convicted,	3 00	
Mark H. Simonds,	Roxbury,		Convicted,	3 00	
Ernest Cragin,	Maplewood,		Convicted,	5 00	
Arthur Cornio,	Maplewood,		Convicted,	5 00	
Coleman Flaherty,	East Boston,		Convicted,	10 00	Went to jail.
John Kane,	East Boston,		Convicted,	3 00	
Wm. G. Walsh,	East Boston,		Convicted,	3 00	
Joseph H. Foster,	East Boston,		Convicted,	3 00	
Joseph Kane,	East Boston,		Convicted,	3 00	
George H. Tyler,	Somerville,		Convicted,	5 00	
George Crowell,	Dorchester,		Convicted,	5 00	
Edward E. Broughton,	Lynn,		Convicted,	10 00	
Thomas Athy,	Lynn,		Convicted,	10 00	
George L. Cagle,	Nahant,		Convicted,	10 00	
Edward Feeney,	South Boston,		Convicted,	5 00	
Patrick Carr,	South Boston,		Convicted,	5 00	

Patrick O'Loughlin,	South Boston,	Taking shellfish in violation of section 114, Chapter 91, Revised Laws, as amended by chapter 285, Acts of 1907; also chapter 403, Acts of 1909, and chapter 177, Acts of 1910,	Convicted,	5 00	
Norman H. Foster,	Melrose,		Convicted,	5 00	
Manuel Gonvea,	New Bedford,		Convicted,	–	Filed.
Henry Souza,	New Bedford,		Convicted,	–	Filed.
Manuel Sylvia,	New Bedford,		Convicted,	–	Filed.
Manuel De Mello,	New Bedford,		Convicted,	–	Filed.
Wm. A. Robertson,	East Dedham,		Discharged,	–	
Fred Y. Oliver,	Athol,		Discharged,	–	
Ernest Scharflen,	Springfield,		Convicted,	15 00	
Charles Rowley,	North Adams,		Convicted,	10 00	Fine remitted.
William H. Jenkins,	Hudson,		Convicted,	–	Filed.
Waldo Gay,	Hudson,		Convicted,	–	Filed.
Howard Blanchard,	Duxbury,		Convicted,	10 00	
Frank Beneati,	Lenox,		Convicted,	10 00	
Peter Guillon,	Lenox,		Convicted,	10 00	
Lewis Guelgame,	Lenox,		Convicted,	10 00	
Michael Sullivan,	Lawrence,		Convicted,	15 00	Appealed.
John Scanlon,	Lawrence,		Convicted,	15 00	Appealed.
John Fitzgerald,	Lawrence,		Convicted,	15 00	Appealed.
Michael Di Lisio,	Swampscott,	Hunting on Lord's day in violation of chapter 176, Acts of 1904,	Convicted,	10 00	
Dennis Valerio,	Westfield,		Convicted,	10 00	
James Matti,	Westfield,		Convicted,	10 00	
Louis Garlo,	Westfield,		Convicted,	10 00	
Christopher Sabino,	Maynard,		Convicted,	10 00	
Vincenzo Prezniso,	Boston,		Convicted,	10 00	
Austochio Rocono,	Athol,		Convicted,	–	Filed.
Rocco Mabroni,	Hingham,		Convicted,	10 00	
Pasquale Demar,	Hingham,		Convicted,	10 00	
Rocco Maurello,	Everett,		Discharged,	–	
John Maurello,	Everett,		Discharged,	–	
Cores Domnichetti,	North Woburn,		Convicted,	–	Filed.
Domernick Fulcinti,	Cohasset,		Convicted,	–	Filed.
Elmer Nickerson,	East Saugus,		Convicted,	–	Filed.
Manuel B. Start,	Chicago, Ill.,		Discharged,	–	
Frank Triano,	Holden,		Convicted,	–	Filed.
Dominic Bova,	Natick,		Convicted,	10 00	
Luigi Trapea,	Natick,		Convicted,	10 00	
Virginio Saconi,	Roxbury,		Convicted,	10 00	
Manuel Zammetti,	Roxbury,		Convicted,	10 00	
Samuel Calambrino,	Roxbury,		Convicted,	10 00	
Haleck Sacco,	Roxbury,		Convicted,	10 00	
Marco Vendela,	Randolph,		Convicted,	10 00	
Charles Goss,	Lowell,		Convicted,	5 00	
Wilber G. Parker,	Brimfield,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Joseph English,	East Lexington,	Hunting on Lord's day in violation of chapter 176, Acts of 1904,	Discharged,	–	
Clarence O. Hallquist,	Seekonk,		Convicted,	$10 00	
William Thayer,	Hanson,		Convicted,	10 00	
Dominic Salve,	Saxonville,		Convicted,	10 00	
William H. Martin,	Needham,		Convicted,	10 00	
Wilson C. Emery,	Springfield,		Convicted,	10 00	
Leon Severance,	Greenfield,		Convicted,	10 00	
Tony Saser,	Hudson,		Convicted,	10 00	
Manuel Correira,	New Bedford,		Convicted,	10 00	
Ozari Chicago,	Leeds,		Convicted,	15 00	
Ralph J. Lardly,	Conway,		Convicted,	–	Filed.
Edward F. Atkins,	Belmont,		Convicted,	–	Filed.
Henry H. Meyer,	Cambridge,		Convicted,	–	Filed.
Edward J. Leuchardt,	Greenfield,		Convicted,	–	Filed.
Frank Parr,	Lee,		Convicted,	15 00	
Albion Ackerman,	Newburyport,		Convicted,	10 00	
Harry C. Magee,	West Springfield,		Convicted,	10 00	
Albert E. Martin,	Attleborough,		Convicted,	10 00	
Pietro Gerardo,	Worcester,		Convicted,	10 00	
Wm. Kellogg,	South Amherst,		Convicted,	15 00	
Angelo Panato,	Wenham,		Convicted,	20 00	
Hiram B. Wood,	Brockton,	Residents hunting without certificate of registration, in violation of chapter 484, Acts of 1908, as amended by chapter 614, Acts of 1910, and chapter 235, Acts of 1911.	Convicted,	10 00	
Wm. L. Kelly,	Cambridge,		Convicted,	–	Filed.
Michael Galvin,	Cambridge,		Convicted,	–	Filed.
Lyman H. Glover,	Greenfield,		Convicted,	15 00	
Warren I. Whittaker,	Scituate,		Convicted,	10 00	
William T. Sylvia,	North Tisbury,		Convicted,	–	Filed.
Matthew V. Sylvia,	New Bedford,		Convicted,	10 00	
Wilfred Fairfield,	Pittsfield,		Convicted,	10 00	
Roger Bassett,	Harwich,		Convicted,	–	Filed.
Frederic Ellis,	Harwich,		Convicted,	–	Filed.
Augustus W. Soule,	Brookline,		Convicted,	10 00	
Wm. Ray Baldwin,	Boston,		Convicted,	10 00	
John E. Fuller, Jr.,	Essex,		Convicted,	10 00	
Albert Foisy,	Worcester,		Discharged,	–	
Robert Lowe,	Pittsfield,		Convicted,	10 00	
Clarence Lowe,	Pittsfield,		Discharged,	–	
George Nelson,	Pittsfield,		Discharged,	–	
Elmer E. Green,	Newburyport,		Convicted,	10 00	

Walter S. Murray,	Lynn,	Residents hunting without certificate of registration, in violation of chapter 484, Acts of 1908, as amended by chapter 614, Acts of 1910, and chapter 235, Acts of 1911,	Convicted,	10 00	
Paul Bergman,	Adams,		Convicted,	10 00	
Felix LeGoff,	Melrose,		Convicted,	10 00	
Lawrence Wood,	Lanesborough,		Convicted,	10 00	
Elmer Nickerson,	East Saugus,		Convicted,	10 00	
Ezra Lothrop,	Avon,		Convicted,	10 00	
Casino Buttero,	Sudbury,		Convicted,	–	Filed.
Harold Pearl,	East Boston,		Convicted,	10 00	
William Keenan,	Haverhill,		Convicted,	10 00	
William E. Fennell,	Dorchester,		Convicted,	10 00	
Charles Amsden,	Prescott,		Convicted,	10 00	
Fred J. Gleason,	Holyoke,		Convicted,	20 00	
Henry W. Williams,	Holyoke,		Convicted,	10 00	
Edward Thomas,	Holyoke,		Convicted,	10 00	
Clarence Royce,	Quincy,		Convicted,	15 00	
Frank Royce,	Quincy,		Convicted,	10 00	
Charles E. Baxter,	Lynn,		Convicted,	10 00	
Thomas L. Suttle,	Lanesborough,		Convicted,	10 00	
Edward J. Stone,	Sherborn,		Convicted,	10 00	
Thomas L. Allen,	Concord,		Convicted,	15 00	
Earl L. Fuller,	Lynn,		Convicted,	10 00	
Wallace Hobbs, Jr.,	East Saugus,		Convicted,	10 00	
George Thimber,	Lowell,		Convicted,	–	Thirty days house of correction; sentence suspended.
Harold T. Cleveland,	South Dartmouth,		Convicted,	10 00	
August F. Beckman,	South Dartmouth,		Convicted,	10 00	
Chester Williams,	Topsfield,		Convicted,	10 00	
William Donovan,	Lawrence,		Convicted,	–	Filed.
James Burke,	Lawrence,		Convicted,	–	Filed.
Ceylon Blake,	Leominster,		Convicted,	10 00	
Justin M. Edwards,	Beverly,		Convicted,	10 00	
Seymour Babb,	Southwick,		Convicted,	10 00	Appealed.
Edward R. Sanford,	Raynham,		Convicted,	15 00	
George MacDonald,	Salem,		Convicted,	10 00	
Elroy Sands,	Salem,		Convicted,	10 00	
Cæsar Ritter,	Fall River,		Convicted,	10 00	
Myron Littlehall,	Fitchburg,		Convicted,	–	Filed.
H. K. Tufts,	Roxbury,		Convicted,	10 00	
William Martin,	North Andover,		Convicted,	10 00	
Anton Thaler,	Gill,	Aliens hunting without license, in violation of chapter 317, Acts of 1905, as amended by chapter 402, Acts of 1908, and further amended by chapter 614, Acts of 1910,	Convicted,	25 00	
Elias Abdelard,	Boston,		Convicted,	10 00	
Lewis Guelgame,	Lenox,		Convicted,	10 00	
Nicholas Najjar,	Boston,		Convicted,	10 00	Appealed.
Antonio Hormsy,	Natick,		Convicted,	10 00	Appealed.
Michael Di Lisio,	Swampscott,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
George Gidzmor,	Barre,	Aliens hunting without license, in violation of chapter 317, Acts of 1905, as amended by chapter 402, Acts of 1908, and further amended by chapter 614, Acts of 1910,	Convicted,	$25 00	
Anthony Gidzmor,	Barre,		Convicted,	25 00	
Frank Gidzmor,	Barre,		Convicted,	25 00	
Salvatore Cosenza,	Boston,		Convicted,	10 00	
Austochio Rocono,	Athol,		Convicted,	10 00	
Domerniek Fulcinti,	Cohasset,		Convicted,	25 00	
Frank Priano,	Holden,		Convicted,	10 00	
Necoto Disgrosso,	East Boston,		Convicted,	10 00	
Edward Farraio,	East Boston,		Convicted,	10 00	
Wm. O. Ferrari,	Orange,		Convicted,	50 00	
John Davidio,	East Boston,		Convicted,	10 00	
Pasquale Caponi,	Boston,		Convicted,	10 00	
Tony Capapolitz,	Haverhill,		– –	–	Defaulted.
Haleck Sacco,	Roxbury,		Convicted,	10 00	
Marco Vendela,	Randolph,		Convicted,	10 00	
Vello Vizilio,	Cheshire,		Convicted,	20 00	
Edwin J. Diotti,	East Saugus,		Convicted,	–	Filed.
Michael Mantyk,	Worcester,		Convicted,	15 00	
Fred Terrazano,	Lawrence,		Convicted,	–	Filed.
Guido Bonafini,	Quincy,		Convicted,	–	Filed.
Francesco Buganti,	Middlefield,		Convicted,	50 00	
Attelo Beveln,	Quincy,		Convicted,	10 00	
Frank Onero,	Shirley,		Discharged,	–	
Frank Carbate,	Pittsfield,		Convicted,	15 00	
Frank Parr,	Lee,		Convicted,	25 00	
Aleck Rocowanoski,	Gardner,		Convicted,	10 00	
Albert Gendron,	North Grafton,		Convicted,	10 00	
Pietro Gerardo,	Worcester,		Convicted,	–	Filed.
Frank Grano,	Webster,		Convicted,	10 00	
Antonio Ross,	Webster,		Convicted,	–	Costs of court, $1.58.
Carl W. Anderson,	Brockton,	Fishing in closed ponds, in violation of chapter 285, Acts of 1911,	Convicted,	20 00	
Frank J. Bergstrom,	Brockton,		Convicted,	20 00	
Michael P. Delorey,	Concord,		Discharged,	–	
Harry M. Stoadley,	Somerville,		Convicted,	3 00	
Charles H. Shaw,	Somerville,		Convicted,	3 00	
Fred Lambert,	Marlborough,		Convicted,	3 00	
William Langelier,	Marlborough,		Convicted,	3 00	
Lewis Roberts,	Marlborough,		Convicted,	3 00	

Elmer E. Newell,	Boston,	Fishing in closed ponds, in violation of chapter 285, Acts of 1911,	Convicted,	–	Filed
William E. Weston,	Boston,		Convicted,	–	Filed.
Frank J. Weston,	Boston,		Convicted,	–	Filed.
F. W. Barrows,	Lowell,		Convicted,	10 00	
Alton H. Hathaway,	Cambridge,		Convicted,	5 00	
Lester D. Hathaway,	Cambridge,		Convicted,	5 00	
Enrico Saverno,	Holyoke,		Convicted,	20 00	
Guiseppi Alfieri,	Holyoke,	Hunting or killing deer, in violation of chapter 545, Acts of 1910,	Convicted,	20 00	
Linwood Richards,	Rowe,		Discharged,	–	
George Gidzmor,	Barre,		Convicted,	–	Filed.
Frank Gidzmor,	Barre,		Convicted,	–	Filed.
Clarence E. Bates,	Huntington,		Discharged,	–	
Milton A. Robbins,	Littleton,		Discharged,	–	
Raymond R. Senior,	Byfield,		Convicted,	–	Six months probation.
Thomas H. Hickey,	Hadley,		Convicted,	50 00	
William Comins,	Hadley,		Convicted,	50 00	
Frank R. Sweet,	Attleborough,		Convicted,	50 00	
Richard S. Harding,	Attleborough,		Convicted,	50 00	
Anthony Mouscabbage,	Athol,		Convicted,	–	Filed.
Frank Bravvard,	Athol,	Having in possession pickerel under 10 inches in length, in violation of section 67, chapter 91, Revised Laws, as amended by chapter 329, Acts of 1904,	Convicted,	4 00	Costs of court, $2.08.
Jacob Stone,	Springfield,		Convicted,	2 00	
Isidor Moyoski,	Springfield,		Convicted,	2 00	
Koslanti Zulkiewicz,	Gardner,		Convicted,	10 00	
Stifia Luska,	Gardner,		Convicted,	–	Filed.
Frank L. Baker,	Worcester,		Convicted,	5 00	
George R. Mason,	Worcester,		Convicted,	5 00	
Frank L. Benner,	Worcester,		Convicted,	5 00	
Caspar Schindler,	Milton,		Convicted,	2 00	
Alexander Tacy,	Northampton,		Convicted,	5 00	
James N. Gardner,	Everett,	Having in possession lobsters under the legal length, in violation of chapter 303, Acts of 1907,	Convicted,	16 00	
Joseph Lopes,	Gloucester,		Convicted,	26 00	
Edward Crowell,	Nahant,		Convicted,	6 00	
Joseph Viator,	Gloucester,		Convicted,	–	Filed.
Frank Viator,	Gloucester,		Convicted,	14 00	
Andrew Prouty,	Cohasset,		Convicted,	5 50	
Manuel Oliver,	Cohasset,		Convicted,	10 00	
William Andrews,	Plymouth,		Convicted,	3 00	
John J. Stillman,	Rockport,		Convicted,	200 00	Paid in superior court.
George H. Sampson,	Plymouth,		Convicted,	10 00	
Joseph Phaneuf,	New Braintree,	Having trout under 6 inches in possession, in violation of chapter 377, Acts of 1909; also chapter 469, Acts of 1910,	Convicted,	5 00	
Louis W. Hooper,	Springfield,		Convicted,	5 00	
Leon Besan,	Huntington,		Discharged,	–	
Frank Brugger,	Pittsfield,		Convicted,	10 00	
Charles Kelly,	Pittsfield,		Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
William Suttle,	Pittsfield,	Having trout under 6 inches in possession, in violation of chapter 377, Acts of 1909; also chapter 469, Acts of 1910,	Convicted,	$10 00	
Denslow Stockwell,	South Hadley,		Convicted,	5 00	
William C. Halliday,	Westfield,		Convicted,	5 00	
Frank T. Woodward,	Northampton,		Convicted,	5 00	
Sandy Malone,	East Brookfield,	Killing gray squirrels, in violation of chapter 172, Acts of 1911,	– –	–	On probation until Jan. 1, 1912.
Domernick Fulcinti,	Cohasset,		Convicted,	–	Filed.
Erland R. Porter,	Avon,		Convicted,	10 00	
Raymond Smith,	Waltham,		Convicted,	–	Filed.
Ralph Hodge,	Waltham,		Convicted,	–	Filed.
Frank Savage,	Worcester,		Convicted,	10 00	
Max Frederick,	Arlington,		Convicted,	–	On probation until March 1, 1912.
Archie Sproul,	Byfield,		Convicted,	–	Filed.
Archie Maynard,	Ayer,	Shooting song or insectivorous birds, in violation of section 7, chapter 92, Revised Laws, as amended by section 1, chapter 250, Acts of 1907,	Discharged,	–	Juvenile.
Albert C. Alderisio,	East Boston,		Convicted,	20 00	
Rocco Bruno,	East Boston,		Convicted,	–	Filed.
Cores Domnichetti,	North Woburn,		Convicted,	10 00	Costs of court, $2.20.
Wm. O. Ferrari,	Orange,		Convicted,	70 00	
Celestiano Di Giovanni,	Foxborough,		Convicted,	10 00	
Herbert West,	Fall River,		Convicted,	10 00	
Thos. W. Fitzgerald,	Springfield,		Convicted,	–	Filed.
George E. Churchill,	Newbury,	Killing pheasants, in violation of chapter 309, Acts of 1909,	Convicted,	5 00	
Edwin J. Diotti,	East Saugus,		Convicted,	–	Filed.
Earl L. Fuller,	Lynn,		Convicted,	–	Filed.
Wallace Hobbs, Jr.,	East Saugus,		Convicted,	–	Filed.
Michael D. Murphy,	Cambridge,		Convicted,	10 00	Appealed.
Justin M. Edwards,	Beverly,		Convicted,	25 00	
William Walke,	Salem,		Convicted,	10 00	
Fred Coots,	Brockton,		Convicted,	5 00	
Edwin C. Drake,	Westfield,	Illegal possession or taking of rabbits, in violation of chapter 118, Acts of 1911,	Convicted,	–	Filed.
Edward Mosely,	Sheffield,		Convicted,	5 00	
H. V. Horton,	Tisbury,		Discharged,	–	
Frank Gollard,	Tisbury,		Discharged,	–	
Newton E. Stout,	Forest Hills, N. J.,	Nonresidents hunting without license, in violation of chapter 198, Acts of 1907, as amended by chapter 262, Acts of 1909,	Convicted,	10 00	
Manuel B. Start,	Chicago, Ill.,		Discharged,	–	
Norman Dubois,	Montclair, N. J.,		Convicted,	30 00	
J. Wilson McCrillis,	Providence, R. I.,		Convicted,	–	Filed.
Peter England,	Providence, R. I.,		Convicted,	10 00	

Sydney V. Este,	Pennsylvania,	Shooting from power boat, in violation of chapter 533, Acts of 1910, as amended by chapter 101, Acts of 1911,	Convicted,	5 00	
Paul G. Theband, Jr.,	New York,		Discharged,	–	
Prescott Arnold,	Rockland,		Convicted,	–	Filed; costs of court, $6.25.
Edward B. Smith,	Waltham,		Convicted,	15 00	
Andrew Grey,	Townsend,		Convicted,	15 00	
Albert Row,	Cambridge,	Hunting with ferret, in violation of chapter 533, Acts of 1910, as amended by chapter 101, Acts of 1911,	Convicted,	15 00	
Warren Teal,	Waltham,		Convicted,	15 00	
Edwin A. Fitch,	Springfield,		Convicted,	20 00	
Albert P. Ward,	Springfield,		Convicted,	20 00	
John J. Tangney,	Worcester,		Convicted,	–	Filed.
Anthony Mouscabbage,	Athol,	Assault on deputy,	Convicted,	15 00	Costs of court, $1.88.
Leon Besan,	Huntington,		Convicted,	15 00	
Albion Fry,	Beverly,		Convicted,	–	Filed.
Pietro Gerardo,	Worcester,		Convicted,	20 00	
Arcade Moran,	Fall River,		Convicted,	20 00	
Frank Gidzmor,	Barre,	Possession of ruffed grouse in close season, in violation of chapter 236, Acts of 1911,	Convicted,	20 00	
Oscar H. Hersey,	Ludlow,		Convicted,	20 00	
Henry W. Williams,	Holyoke,		Convicted,	20 00	
George H. Prior,	Boston,		Convicted,	–	Filed.
Amasa R. Staples,	South Bellingham,		Convicted,	–	Filed.
Charles E. Baxter,	Lynn,	Hunting on posted land, violation of chapter 362, Acts of 1909,	Convicted,	10 00	
Dominic Salve,	Saxonville,		Convicted	10 00	
Erricola Mattioli,	Southborough,		Convicted,	10 00	
Joseph Whalen,	Lee,		Convicted,	10 00	
Vilosi Giovani,	Framingham,	Setting or using snares or traps, in violation of chapter 533, Acts of 1910, as amended by chapter 101, Acts of 1911,	Convicted,	10 00	
Carleton E. Natar,	Tisbury,		Convicted,	5 00	
George Thimber,	Lowell,		Convicted,	25 00	
Dwelly Smith,	North Easton,		Convicted,	10 00	
Luigi Scucla,	Boston,	Torching herring, in violation of chapter 298, Acts of 1908,	Convicted,	50 00	
Calogero La Rosa,	Boston,		Convicted,	50 00	
Lorenzo Scucla,	Boston,		Convicted,	50 00	
Salvatore Sercivia,	Boston,		Convicted,	50 00	
Vitie Tinker,	Hingham,	Possession of smelts in close season, in violation of section 71, chapter 91, Revised Laws,	Convicted,	10 00	
Roco Calva,	Hingham,		Convicted,	10 00	
Douglas Tower,	Weymouth,		Convicted,	–	Filed; placed on probation as delinquent child.
Augustus W. Baker,	Chatham,	Maintaining fish trap without permit, in violation of section 116, chapter 91, Revised Laws,	Convicted,	20 00	
Samuel A. Nickerson,	Eastham,		Convicted,	10 00	
Joseph M. Dill,	Eastham,		Convicted,	10 00	
Clarence O. Hallquist,	Seekonk,	Possession of ferret, in violation of chapter 533, Acts of 1910, as amended by chapter 101, Acts of 1911,	Convicted,	10 00	
Max Noack,	Dudley,		Discharged,	–	
John Manski,	Webster,		Discharged,	–	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

State *v.* —	Town or City.	Offence.	Court Decision.	Fine.	Remarks.
Charles R. Drew,	Medford,	Illegal possession or sale of wild ducks, in violation of chapter 421, Acts of 1909,	Convicted,	$20 00	
Carroll L. Gager,	Mansfield,	Dogs chasing deer, in violation of section 18, chapter 92, Revised Laws, as amended by chapter 245, Acts of 1905,	Convicted,	10 00	
Thomas B. Kinraide,	Sandwich,		Discharged,	–	
James O'Brien,	Westford,		Convicted,	10 00	
Elxis Latte,	Gardner,	Using seine under 5-inch mesh, in violation of section 49, chapter 91, Revised Laws,	Convicted,	–	Filed; costs of court, $0.50.
Mati Okanen,	Gardner,		Convicted,	–	Filed; costs of court, $0.50.
Ankust Halme,	Gardner,		Convicted,	25 00	Costs of court, $0.50.
Charles A. Clough,	Lynn,	Selling clams taken from contaminated waters, in violation of chapter 285, Acts of 1907,	– –	–	
Samuel A. Wormsted,	Saugus,		– –	–	Continued for sentence.
Edward Feeney,	South Boston,		Convicted,	25 00	Appealed.
Edward J. Moran,	Lynn,	Buying clams taken from contaminated waters, in violation of chapter 285, Acts of 1907,	Convicted,	25 00	
George W. Wheeler,	Boston,		Convicted,	50 00	Filed in superior court.
John Reynolds,	Vineyard Haven,	Seining in Edgartown, in violation of chapter 281, Acts of 1905,	Convicted,	–	Filed.
Frank Canara,	Vineyard Haven,		Convicted,	–	Filed.
Linwood Richards,	Rowe,	Possession of over one deer in open season, in violation of chapter 545, Acts of 1910,	Discharged,	–	
Joseph Kessler,	Lanesborough,		Discharged,	–	
Collins E. Howes,	Chatham,	Taking scallops illegally, in violation of chapter 177, Acts of 1910,	Convicted,	5 00	
Philip Mathot,	New Bedford,		Convicted,	10 00	
Charles Scace,	Pittsfield,	Illegal possession of heron, in violation of chapter 244, Acts of 1903,	Convicted,	5 00	
John H. Bufford,	Brookline,		Convicted,	10 00	
Albert A. Parker,	Pittsfield,	Shooting elk, in violation of chapter 545, Acts of 1910,	Convicted,	75 00	
Fred Barnes,	Pittsfield,		Convicted,	75 00	
Joseph Kennedy,	East Weymouth,	Setting nets for smelts, in violation of section 74, chapter 91, Revised Laws,	Convicted,	50 00	Appealed.
Douglass Tower,	Weymouth,		Convicted,	–	Filed.
Joseph English,	East Lexington,	Discharging gun for sport on Lord's day, in violation of chapter 112, Acts of 1908,	Convicted,	5 00	
Arthur Dimachelli,	Belchertown,		Convicted,	5 00	
Edwin Stevens,	Attleborough,	Possession of American egret, in violation of chapter 244, Acts of 1903,	Convicted,	10 00	
Elmer E. Whipple,	Diamond Hill, R. I.,	Nonresident hunting deer, in violation of chapter 545, Acts of 1910,	Convicted,	–	Filed; costs of court, $4.60.
Wm. E. Sprague,	Diamond Hill, R. I.,		Convicted,	–	Filed; costs of court, $4.60.
Otto Schadlisch,	Lawrence,	Possession of birds for millinery, in violation of chapter 329, Acts of 1903,	Convicted,	10 00	

William Connelly,	Roxbury,	Setting forest fires, in violation of chapter 209, Acts of 1908,	Convicted,	5 00	Committed to jail.
Roy Funk,	Egremont,	Using explosives, in violation of chapter 246, Acts of 1903,	Convicted,	10 00	
William Thayer,	Hanson,	Killing wild goose illegally, in violation of chapter 181, Acts of 1911,	Convicted,	20 00	
William Thayer,	Hanson,	Possession of wild goose in close season, in violation of chapter 421, Acts of 1909,	Convicted,	20 00	
Dwight Cooley,	Dana,	Shooting wood duck, in violation of chapter 274, Acts of 1906, as amended by Acts of 1911, chapter 39,	Convicted,	25 00	
Everett E. Cleveland,	Russell,	Possession of short bass, in violation of section 70, chapter 91, Revised Laws,	Convicted,	-	Filed.
Antonio Scala,	Boston,	Taking fish without permit, in violation of chapter 374, Acts of 1911,	Convicted,	20 00	
George H. Prior,	Boston,	Shipping ruffed grouse out of State, in violation of section 21, chapter 92, Revised Laws,	Discharged,	-	
Joseph Kessler,	Lanesborough,	Killing deer with rifle in open season, in violation of chapter 545, Acts of 1910,	Convicted,	15 00	Appealed.
Robert D. Barnes,	Ware,	Trapping with scented bait, in violation of chapter 215, Acts of 1911,	Convicted,	-	Filed.
Abraham Maloufe,	Lawrence,	Spearing trout and bass, in violation of section 132, chapter 91, Revised Laws, as amended by chapter 429, Acts of 1908,	Convicted,	5 00	
Frederick Wester,	South Hadley Falls,	Using over 10 hooks on stocked ponds in violation of section 26, chapter 91, Revised Laws, as amended by chapter 308, Acts of 1904,	Convicted,	20 00	
George K. Hamson, Jr.,	Marblehead,	Mutilation of lobsters, in violation of section 81, chapter 91, Revised Laws,	Convicted,	15 00	
Napoleon Letiecz,	Worcester,	Hunting ducks, in violation of chapter 187, Acts of 1911,	Discharged,	-	
Edward M. Plummer,	Newburyport,		Convicted,	-	Filed.
George A. Weare,	Newburyport,		Convicted,	-	Filed.
Harry L. Young,	Lowell,	Refusal to display on demand, in violation of chapter 255, Acts of 1908,	Discharged,	-	
George R. Campbell,	Nahant,	Hunting an eagle, in violation of chapter 118, Acts of 1907,	Convicted,	20 00	
Louis A. Petts,	Gardner,	Shooting pickerel, in violation of chapter 492, Acts of 1908,	Convicted,	-	Filed; costs of court, $2.45.

[F.]

Returns from the Shore Net and Pound Fisheries for the Year 1911.

Apparatus employed.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pounds.	Value.	Number of Nets.	Value.
Frank C. Hodgkins, Preston J. Marchant,	Annisquam,	11	6	$2,300 00	–	–	4	$1,000 00
Ensign C. Jerauld,	Barnstable,	9	4	1,100 00	2	$2,500 00	–	–
J. E. Eldridge, Fred Young, Gilbert E. Ellis, A. S. Hall,	Brewster,	7	6	250 00	8	1,400 00	4	90 00
George W. Crowell, Benj. F. Rich, Geo. N. Bearse, Roscoe H. Gould, Fred W. Baker, Wm. A. Bloomer, Samuel Dill, Seymour Patterson,	Chatham,	15	15	2,440 00	7	3,925 00	101	1,100 00
E. C. Flanders & Co., Flanders & Mayhew, Daniel W. West,	Chilmark,	15	16	1,475 00	11	5,250 00	–	–
Geo. A. Finney, agent,	Chiltonville,	2	3	225 00	1	1,000 00	–	–
Isaac Gregory,	Cuttyhunk,	1	2	758 00	–	–	1	85 00
Oscar F. Gibbs, A. P. Howes,	Dennis,	–	–	–	–	–	4	30 00

Charles Gardner, E. D. Perry, A. F. Simmons,	Dighton,	18	12	745 00	2	100 00	5	500 00
Harry E. Hunt,	Duxbury,	4	4	2,525 00	5	3,000 00	22	410 00
D. B. Pease and Allen Mayhew,	Edgartown,	2	3	35 00	1	100 00	-	-
L. S. Jeffers & Co., A. H. Vanderhoop & Co., L. L. Vanderhoop, J. A. Mayhew,	Gay Head,	13	12	1,285 00	8	5,700 00	-	30 00
Fuller A. Andrews, Geo. W. Douglass, Thomas Douglass, Henry W. Nelson, Alexander Sargent, C. W. Tarr, Joseph Douglass,	Gloucester,	12	19	3,122 00	1	1,000 00	19	1,325 00
Clinton F. Sturges, Ansel Taylor, Orin Crosby, Geo. W. Sturges,	Hyannis,	11	9	2,500 00	-	-	69	775 00
Alfred W. Riley,	Lanesville,	-	-	-	-	-	10	50 00
Edw. W. Heath,	Manchester,	4	5	555 00	1	1,500 00	-	-
C. D. Bacon, Whitfield Hamilton,	Manomet,	2	2	75 00	-	-	-	-
H. D. Powell (F. H. Johnson and others), Avard L. Smith (R. A. Atwood and others),	Nahant,	12	7	1,400 00	4	6,000 00	-	-
Arthur J. Barrett, Nelson Clark, Edward J. Fisher, W. H. Hamblin, Arthur McCleare, John S. Watkins,	Nantucket,	21	22	7,500 00	7	3,800 00	278	3,810 00

Apparatus employed — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pounds.	Value.	Number of Nets.	Value.
C. A. Caswell & Co., Geo. G. Short,	Newburyport,	11	5	$2,875 00	–	–	5	$1,150 00
Otis E. Burt,	North Tisbury,	1	2	225 00	2	$600 00	–	–
Fred C. Rich,	North Truro,	12	10	3,290 00	6	12,600 00	–	–
Louis G. Doten, Harry H. Chase,	Plymouth,	3	3	330 00	–	–	1	100 00
A. L. Daggett, James W. Fuller, John Johnson, James E. Kelley, A. P. Lewis and Manuel James, Thomas J. Lewis, William B. Lewis, Alfred A. Mayo, H. L. Mayo, Martin Nelson, Frank I. Sears, Edwin W. Smith, John R. Swartz, Manuel P. Vera, J. R. Williams, Manuel Snow,	Provincetown,	45	50	15,470 00	4	5,500 00	619	4,575 00
Edwin Williams,	Raynham,	21	4	200 00	–	–	3	300 00
Chas. P. R. Fellows,	Salem,	1	1	10 00	–	–	–	–
A. N. Goff,	Segregansett,	17	4	150 00	–	–	4	300 00
John Elvander,	Sandwich,	–	–	–	–	–	3	30 00
Thomas S. Turner,	Scituate,	–	–	–	–	–	4	40 00
J. H. Miller,	Somerset,	11	3	100 00	–	–	1	100 00
Hiram E. Baker,	South Dennis,	2	2	20 00	–	–	1	50 00

Obed S. Daggett,								
George H. Luce,								
H. Nelson Luce,								
W. L. & G. F. Tilton,	Tisbury,	23	31	3,330 00	21	6,750 00	-	-
John R. Walker,								
Otis B. Luce,								
E. P. Cook,	Wellfleet,	1	-	-	-	-	-	-
Zenas H. Baker,	West Dennis,	6	4	1,015 00	3	3,000 00	-	-
Frederick R. Gifford,								
John J. Veeder (Marine Biological Laboratory),	Woods Hole,	4	7	6,095 00	1	500 00	1	20 00
Antone Vieria,								
Shirley D. Lovell,	Yarmouth,	2	4	830 00	1	150 00	25	250 00
		319	277	$62,230 00	96	$64,375 00	1,184	$16,120 00

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Scup.
Allerton,	–	–	–	–	–	–	–	–
Annisquam,	–	–	–	8,846	–	400,010	–	–
Barnstable,	–	–	200	114,310	–	40,500	–	–
Bay View,	–	–	–	–	–	–	–	–
Beachmont,	–	–	–	–	–	–	–	–
Beverly,	–	–	–	–	–	–	–	–
Brewster,	48,360	–	1,844	–	–	–	–	–
Boston,	–	–	–	–	–	–	–	–
Bournedale,	–	–	–	–	–	–	–	–
Brant Rock,	–	–	–	–	–	–	–	–
Chatham,	14,500	10,020	103,500	118,710	1,500	–	–	1,602
Chilmark,	–	–	5,702	23,058	17,500	16	–	27,445
Chiltonville,	–	–	–	9,630	–	–	–	–
Cohasset,	–	–	–	–	–	–	–	–
Cuttyhunk,	–	–	–	–	–	–	–	–
Dennis,	–	–	–	300	–	–	–	–
Dighton,	182,400	–	–	–	–	–	–	–
Duxbury,	–	–	–	7,075	–	37,670	–	–
East Mattapoisett,	–	–	–	–	–	–	–	–
Edgartown,	–	–	410	630	–	–	–	240
Gay Head,	21,000	–	6,900	11,600	–	–	–	18,800
Gloucester,	9,000	–	444	11,988	2,550	105,153	–	–
Green Harbor,	–	–	–	–	–	–	–	–
Hull,	–	–	–	–	–	–	–	–
Hyannis,	–	22,808	56,800	18,188	500	–	–	–
Kingston,	–	–	–	–	–	–	–	–
Lanesville,	–	–	–	610	–	–	–	–
Magnolia,	–	–	–	–	–	–	–	–
Manchester,	13,450	–	–	12,263	2,000	134,448	–	–
Manomet,	–	–	400	–	50	–	–	–
Marblehead,	–	–	–	–	–	–	–	–
Mattapoisett,	–	–	–	–	–	–	–	–
Minot,	–	–	–	–	–	–	–	–
Nahant,	–	–	–	2,566	1,266	10,600	–	–
Nantasket,	–	–	–	–	–	–	–	–

in Pounds, Nets, Traps, etc.

Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Total.	Value.
–	–	–	–	–	–	–	–	834	834	$125 00
–	185,650	20,040	–	–	–	–	431,380	425	1,046,351	9,918 53
–	28,000	–	–	–	1,000	500	27,800	1,093	213,403	8,649 70
–	–	–	–	–	–	–	–	2,472	2,472	249 25
–	–	–	–	–	–	–	–	8,393	8,393	1,364 50
–	–	–	–	–	–	–	–	2,262	2,262	321 08
–	16,500	–	–	17	–	57	1,600	–	68,378	1,474 15
–	–	–	–	–	–	–	–	2,699	2,699	449 75
–	–	–	–	–	–	–	–	19,574	19,574	2,002 75
–	–	–	–	–	–	–	–	17,345	17,345	1,742 51
–	24,800	660	10,756	–	130,290	2,150	81,800	17,133	517,421	13,196 19
5,426	–	–	30,054	–	9,350	90	53,682	19,086	191,409	7,663 26
–	–	–	–	–	–	–	–	33,324	42,954	4,046 54
–	–	–	–	–	–	–	–	60,402	60,402	8,891 56
–	–	–	–	–	–	850	–	104,349	105,199	11,583 23
–	–	–	–	–	–	–	–	4,167	4,467	620 25
–	–	2,680	–	–	–	–	5,100	–	190,180	2,843 60
–	249,400	–	–	–	–	–	215,764	6,059	515,968	8,035 70
–	–	–	–	–	–	–	–	251	251	90 00
–	–	–	230	–	6,000	20	2,650	21	10,201	199 95
11,400	–	100	13,400	–	5,700	500	800	16,688	106,888	5,351 25
–	82,536	332	–	–	14,645	295	801,900	86,478	1,115,321	16,793 73
–	–	–	–	–	–	–	–	138,459	138,459	16,420 11
–	–	–	–	–	–	–	–	33,786	33,786	4,722 89
–	–	–	560	–	–	–	–	10,217	109,073	5,397 86
–	–	–	–	–	–	–	–	9,681	9,681	1,252 05
–	–	–	–	–	–	–	–	5,771	6,381	1,156 23
–	–	–	–	–	–	–	–	2,144	2,144	314 38
3,110	121,100	3,825	–	–	–	–	285,332	–	575,528	5,820 78
–	–	–	–	–	–	–	13,350	113,303	127,103	11,255 89
–	–	–	–	–	–	–	–	156,336	156,336	13,150 54
–	–	–	–	–	–	–	–	5,085	5,085	688 41
–	–	–	–	–	–	–	–	15,584	15,584	2,229 22
–	598,884	–	–	–	–	–	981,903	29,337	1,624,556	15,316 37
–	–	–	–	–	–	–	–	39,410	39,410	5,708 83

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Scup.
Nantucket,	4,000	58,602	2,550	91,665	–	500	–	6,805
New Bedford,	–	–	–	–	–	–	–	–
Newburyport,	–	–	–	20,822	–	92,210	–	–
North Pembroke,	–	–	–	–	–	–	–	–
North Tisbury,	–	200	4,000	–	–	–	–	400
North Truro,	–	–	6,624	69,956	2,600	40,282	–	–
Orleans,	–	–	–	–	–	–	–	–
Onset,	–	–	–	–	–	–	–	–
Pasque Island,	–	–	–	–	–	–	–	–
Plymouth,	–	–	30	1	–	15	–	–
Pocasset,	–	–	–	–	–	–	–	–
Provincetown,	–	300	1,009,718	198,825	–	4,950	9	–
Raynham,	354,400	–	–	–	–	–	–	–
Robinson Hole,	–	–	–	–	–	–	–	–
Rockport,	–	–	–	–	–	–	–	–
Sagamore,	–	–	–	–	–	–	–	–
Salem,	–	–	2,000	–	–	–	–	–
Sandwich,	–	–	1,575	61	–	–	–	–
Scituate,	–	–	–	380	–	–	–	–
Segregansett,	446,500	–	–	–	–	–	–	–
Somerset,	260,000	–	–	–	–	–	–	–
South Dennis,	31,800	–	–	–	–	–	–	–
Tisbury,	33,000	3,530	27,714	6,072	–	2,725	–	37,828
Vineyard Haven,	–	–	–	–	–	–	–	–
Wellfleet,	57,000	–	–	–	–	–	–	–
West Dennis,	6,450	–	26,250	3,302	6,250	–	–	2,400
West Falmouth,	–	–	–	–	–	–	–	–
Westport Point,	–	–	–	–	–	–	–	–
West Tisbury,	–	–	–	–	–	–	–	–
Weymouth,	–	–	–	–	–	–	–	–
Whitman,	–	–	–	–	–	–	–	–
Winthrop,	–	–	–	–	–	–	–	–
Woods Hole,	–	25	8,600	300	–	–	–	25,860
Yarmouth,	–	–	640	7,400	–	–	–	–
	1,481,860	95,485	1,265,901	738,558	34,216	869,079	9	121,380

in Pounds, Nets, Traps, etc. — Concluded.

Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Lobsters.	Total.	Value.
150	–	–	9,348	–	19,400	–	67,116	5,379	265,515	$18,070 03
–	–	–	–	–	–	–	–	6,009	6,009	707 35
–	81,800	26,000	–	–	–	–	174,571	–	395,403	6,104 44
–	–	–	–	–	–	–	–	1,458	1,458	141 26
–	–	–	3,300	–	–	–	–	3,189	11,089	1,502 25
–	1,488,100	32	–	–	502,060	100	670,322	–	2,780,076	22,712 96
–	–	–	–	–	–	–	–	3,533	3,533	947 31
–	–	–	–	–	–	–	–	3,600	3,600	480 00
–	–	–	–	–	–	–	–	1,662	1,662	172 64
–	60,000	–	–	–	–	–	19,707	58,899	138,652	7,938 94
–	–	–	–	–	–	–	–	170	170	33 60
–	397,700	800	–	–	453,351	200	286,165	4,826	2,356,844	51,632 05
–	–	860	–	–	–	–	–	–	355,260	2,202 10
–	–	–	–	–	–	–	–	2,952	2,952	250 03
–	–	–	–	–	–	–	–	24,794	24,794	2,749 47
–	–	–	–	–	–	–	–	3,027	3,027	416 10
–	–	–	–	–	–	–	–	31,478	33,478	4,358 26
–	100	–	–	–	–	–	1,000	6,630	9,366	855 20
–	–	–	–	–	–	–		26,126	26,506	2,469 13
–	–	3,200	–	–	–	–	2,300	–	452,000	5,155 00
–	–	343	–	–	–	–	–	–	260,343	15,358 00
–	–	–	–	–	–	–	–	–	31,800	318 00
200	13,100	200	75,595	160	6,950	4,614	2,006	–	213,694	10,006 52
–	–	–	–	–	–	–	–	1,236	1,236	181 79
–	–	–	–	–	–	–	–	–	57,000	1,638 75
–	19,350	900	1,800	–	228,975	2,200	32,175	–	330,052	5,380 60
–	–	–	–	–	–	–	–	222	222	29 60
–	–	–	–	–	–	–	–	17,999	17,999	1,933 23
–	–	–	–	–	–	–	–	21,779	21,779	2,742 66
–	–	–	–	–	–	–	–	21,144	21,144	3,251 61
–	–	–	–	–	–	–	–	3,180	3,180	338 40
–	–	–	–	–	–	–	–	2,325	2,325	377 50
–	–	–	6,560	–	7,000	5,800	900	18,150	73,195	4,328 60
–	–	800	–	–	–	–	11,000	1,185	21,025	983 50
20,286	3,367,020	60,772	151,603	177	1,384,721	17,376	4,170,323	1,233,120	15,011,886	$364,812 92

Returns from the Lobster Fisheries.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number Egg-bearing Lobsters.
M. W. Springer,	Allerton,	1	1	$20 00	15	$15 00	556	$125 00	–
Daniel Burnham,	Annisquam,	1	1	–	30	30 00	350	91 00	–
Clarence Chase,	Barnstable,	1	2	400 00	40	30 00	729	136 70	–
Andrew T. Marchant,									
Daniel McDonald,	Bay View,	2	1	18 00	81	122 00	1,648	249 25	12
Charles Neil,	Beachmont,	1	2	620 00	160	450 00	5,595	1,364 50	46
Nelson A. Southwick,	Beverly,	1	2	150 00	50	100 00	1,508	321 08	12
A. Sidney,	Boston,	1	1	–	150	150 00	1,799	449 75	–
A. J. Chandler,									
Frank C. Leonard,									
Percy H. Marsh,	Bournedale,	5	8	485 00	270	315 00	13,049	2,002 75	103
Mendo Morrissey,									
Albert A. Nightingale,									
Fred L. Ford,									
M. H. Hewins,									
William A. Pool,	Brant Rock,	6	11	1,495 00	341	484 00	11,563	1,742 51	28
J. E. White,									
Fred W. Baker,									
Jos. D. Bloomer,									
Wm. A. Bloomer,									
Samuel Dill,									
W. N. Eldredge,									
W. W. Eldridge,									
Chas. G. Hamilton,	Chatham,	16	26	4,320 00	738	1,018 00	11,422	3,621 61	673
T. W. Holway,									
Jas. E. Jones,									
Edson F. Olson,									
Seymour Patterson,									
B. R. Baker,									
Albert W. Carpenter,									
Roy E. Cottle,									
E. J. Dean,									
Wm. S. Mayhew,									
Everett A. Poole,	Chilmark,	10	18	2,510 00	490	1,670 00	12,724	2,223 73	119
Harry G. Reed,									
Austin E. Smith,									
Onslow Stuart,									

Joseph Boutin,									
John E. Finney,									
Ernest Johns,									
Albert F. Pierce,	Chiltonville,	10	17	1,116 00	475	750 00	22,216	3,236 24	44
H. S. Sampson,									
R. T. Swift,									
Levi Thurston,									
Chas. H. Pierce,									
Geo. T. Ainslie,									
Joseph Bandura,									
Levi Cadose,									
Anton Grassie,									
Patrick Grassie,									
John W. Hunt,									
Samuel McDonald,	Cohasset,	16	18	2,702 00	1,460	2,216 00	40,268	8,891 56	40
W. H. Newell,									
Manuel Oliver,									
Harry A. Pattison,									
Andrew Peterson,									
Orne Peterson,									
Manuel L. Trombas,									
D. N. Bosworth,									
Joseph Canaia,									
Harold F. Deane,									
Thomas B. Dowling,									
Isaac Gregory,									
Saml. E. Jackson & Co.,									
George C. King,									
Walter Loveridge,									
Frank Peters,	Cuttyhunk,	24	38	10,110 00	1,776	1,925 50	69,566	11,548 23	596
Louis J. Ramos,									
Russell W. Rotch,									
Roland S. Snow,									
George A. Stetson,									
Frank M. Snyder,									
A. P. Tilton,									
Ernest G. Veeder,									
Frank B. Veeder,									
Harold S. Veeder,									
Oscar F. Gibbs,									
Austin F. Howes,	Dennis,	4	6	308 00	136	80 00	2,778	590 25	72
Ansel P. Howes,									
Benjamin Walker,									
Samuel P. Burgess,	Duxbury,	1	3	115 00	70	125 00	4,039	564 46	72
N. P. Nye,	East Mattapoisett,	1	2	85 00	10	10 00	167	90 00	-
Manuel Deloura,	Edgartown,	1	2	615 00	4	8 00	14	4 20	-

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number Egg-bearing Lobsters.
Granville M. Belain,									
Moses P. Cooper,									
Joseph H. Lang,	Gay Head,	8	12	$630 00	270	$2 0 00	11,125	$1,857 75	131
J. A. Mayhew & Co.,									
Chas. H. Ryan,									
Edward L. Ashley,									
Henry H. Ashley,									
F. B. Brewer,									
J. N. Christensen,									
C. A. Dixon,									
Joseph Douglas,									
William Gallagher,									
Nelson F. King,									
Peter Knutson,									
W. E. Marchant,									
David E. Mehlman,									
Joseph S. Moniz,	Gloucester,	27	34	2,773 00	1,638	2,069 00	57,652	10,791 14	175
John Nelson,									
Albert and Howard Parsons,									
Edwin F. Parsons,									
Jerry Phillips,									
Gustav Rogers,									
Nelson Rowe,									
Elbridge D. Rust,									
Everett L. Small,									
Arthur Stevens,									
Manuel Viator, Jr.,									
Manuel Viator,									
Robert Brown,									
Wm. M. Cushing,									
George Delano,									
W. M. Englestead,									
Geo. W. Gardner,									
Wilfred Keene,									
C. E. Peterson,	Green Harbor,	13	32	5,982 00	1,620	2,880 00	92,306	16,420 11	445
Chas. R. Peterson,									
Lyman Sears,									
A. I. Shaw,									
Herbert P. Tolman,									
Wm. H. Tolman,									

Walter F. Kelley,									
Ambrose B. Mitchell,	Hull,	3	8	692 00	340	610 00	22,524	4,722 89	45
F. C. Munch,									
Orin S. Crosby,									
Chester F. Veeder,									
Nelson B. Marchant,	Hyannis,	3	4	1,024 00	261	258 00	6,811	1,328 44	27
Elmer W. Phinney,									
George W. Sturgis,									
Allen R. Gorham,	Kingston,	2	4	735 00	115	165 00	6,454	1,252 05	14
Henry S. West,									
Alfred W. Riley,									
Addison Woodbury,	Lanesville,	4	4	65 00	155	155 00	3,847	1,063 23	10
Geo. H. Woodbury,									
John B. Knowlton,	Magnolia,	1	2	10 00	38	76 00	1,429	314 38	-
E. H. Arnold,									
C. D. Bacon,									
Edwin H. Bartlett,									
Samuel H. Benson,									
David H. Briggs,									
G. L. Binney,									
Laban B. Briggs, Jr.,									
Laban B. Briggs, Sr.,									
Frank P. Brooks,									
James E. Burke,									
H. D. Cleveland,									
George D. Cook,									
Wm. W. Derick,									
Chas. A. Dixon,									
C. H. Dixon,	Manomet,	34	48	3,670 00	1,624	2,629 00	75,535	10,969 39	295
Archie Fenton,									
Whitfield Hamilton,									
George W. Holmes,									
Ralph B. Holmes,									
William Husband,									
George A. Manter,									
W. J. Nightingale,									
F. R. Peterson,									
Chas. W. Raymond,									
J. E. Raymond,									
Robt. Richardson,									
Rodmond D. Rogers,									
Arthur E. Rudolph,									

Returns from the Lobster Fisheries — Continued.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number Egg-bearing Lobsters.
Wm. F. Allen,									
Chas. O. Briggs,									
J. E. Brown,									
Earnest Cronk,									
W. F. Dennis,									
Arthur D. Frost,									
Wm. T. Gardner,									
Thomas P. Gilbert,									
Everett S. Hamson,									
Geo. K. Hamson, Jr.,									
David P. Howe,									
R. H. Keenan,									
Thomas P. Lyons,									
John W. Mace,	Marblehead,	31	43	$5,950 00	1,421	$1,918 00	104,224	$13,150 54	376
Jas. H. Magee,									
Jonathan B. Mason,									
Harry A. Oliver,									
Everett P. Peach,									
Joseph S. Phillips,									
Augustus H. Roundy,									
R. F. Russell,									
Stephen Q. Smith,									
Wm. T. Smith,									
C. H. Smithurst,									
Samuel Stone,									
John F. Trefry,									
Wm. H. Tutt,									
J. S. Withum,									
Jas. L. Hammond,	Mattapoisett,	2	2	250 00	145	220 00	3,390	688 41	44
Albert D. Peters,									
Chas. De Costa,									
J. H. Gannett,									
C. H. Pratt,	Minot,	7	8	349 00	240	283 00	10,389	2,229 22	35
Eugene Pratt,									
Danforth P. Sylvester,									

E. H. Crowell,									
Gilbert G. Hunt,									
G. H. Lamphier,									
Herbert E. Potter,	Nahant,	6	11	914 00	315	355 00	19,558	3,153 76	141
W. A. Smith,									
Chas. W. Taylor,									
Harry C. Bates,									
R. F. Gardner,									
Geo. L. Hatch,									
Henry E. Hatch,	Nantasket,	6	8	1,023 00	420	642 50	26,273	5,708 83	476
Frank Lean,									
Ephraim Onderkirk,									
E. C. and J. E. Chapel,									
O. C. Fisher,									
Walter Jewett,									
Adolph A. Rohdin,	Nantucket,	7	11	780 00	185	-	3,586	957 77	29
Manuel Thomas,									
John S. Watkins,									
Elliott Wheldon,									
Henry Millett,									
George B. Taber,	New Bedford,	2	3	862 00	150	170 00	4,006	707 35	64
Edmund E. Crossley,	North Pembroke,	2	2	237 00	40	100 00	972	141 26	4
Reed & Maury,	North Tisbury,	2	2	510 00	100	50 00	2,126	439 25	50
Bernard Collins,									
Frank Freeman,									
Daniel B. Gould,	Orleans,	4	6	365 00	120	220 00	2,355	947 31	104
George D. Knowles,									
J. Alton Harrison,	Onset,	2	1	1,000 00	65	65 00	2,400	480 00	50
Clarence King,	Pasque Island,	1	2	1,115 00	50	75 00	1,108	172 64	10
Jas. H. Bagnall,									
Chas. A. Briggs,									
H. J. Caswell,									
H. H. Chace,									
Chas. H. Davis,									
John R. Harlow,	Plymouth,	11	20	3,655 00	800	1,249 00	39,266	6,947 62	154
B. F. Hodges,									
Whitman Nickerson,									
Preston Ray,									
Jos. P. Thurston,									
John M. Watson,									
Geo. W. Bullock,	Pocasset,	1	1	300 00	9	15 00	113	33 60	5

Returns from the Lobster Fisheries — Concluded.

Proprietor.	Town.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number Egg-bearing. Lobsters.
Cushing H. Emery,									
John Enos,									
Joseph S. Perry,									
John W. Savage,	Provincetown,	6	7	$170 00	251	$260 00	3,217	$1,298 98	82
Manuel Snow,									
Chas. Williams, Jr.,									
Manuel Francis,									
Manuel Marshall,	Robinson Hole,	3	3	665 00	105	107 75	1,968	250 03	28
William Carrow,									
Chester W. Gott,									
Charles F. Green,									
Ernest G. Nelson,	Rockport,	6	7	1,045 00	375	502 00	16,496	2,749 47	26
J. P. Nelson,									
Geo. E. Wendell,									
Arthur Gibbs,	Sagamore,	1	1	75 00	90	75 00	2,018	416 10	46
Chas. H. Berry,									
Chas. S. Brown,									
John A. Dunn,									
Chas. P. R. Fellows,	Salem,	7	9	1,265 00	605	830 00	20,985	4,298 26	160
Thos. F. Hogan,									
Louis N. Letourneau,									
Geo. H. Whelpley,									
John Elvander,									
John F. Mahoney,	Sandwich,	2	3	254 00	63	101 00	4,420	822 35	87
Oscar Anderson,									
Thomas Dwyer,									
Geo. F. Edson,	Scituate,	4	8	995 00	293	490 00	17,417	2,431 13	19
Thos. S. Turner,									
Louis E. Smith,									
Geo. E. Whitney,	Vineyard Haven,	2	5	110 00	55	55 00	824	181 79	11
F. J. Densmore,	West Falmouth,	1	1	-	12	12 00	148	29 60	10

Geo. A. Gifford, Geo. W. Hart, Wm. S. Head, Fred W. Palmer, H. G. Sowle, Wm. B. Whalon,	Westport Point,	9	8	2,605 00	358	453 00	11,999	1,933 23	125
David T. Butler, Lester D. Mayhew, Lindley W. Mayhew,	West Tisbury,	3	7	2,149 00	315	450 00	14,519	2,742 66	141
Francis J. Cain, Edwin J. Culley,	Weymouth,	3	3	330 00	280	400 00	14,096	3,251 61	44
N. G. Hatch, Geo. M. Wadsworth,	Whitman,	2	3	300 00	71	131 00	2,120	338 40	1
Hartley L. Wells,	Winthrop,	1	1	150 00	75	150 00	1,550	377 50	-
C. R. Grinnell, Oscar R. Hilton, Thos. Hinkley, Patrick J. Larkin, Alfred Nickerson, W. E. Nickerson, Frank I. Peterson, Prince M. Stuart, Robert N. Veeder, Antone Vieria,	Woods Hole,	10	13	4,854 00	348	394 50	12,100	2,229 10	165
Shirley D. Lovell,	Yarmouth,	-	-	-	60	75 00	790	237 50	41
		341	505	$72,927 00	19,773	$28,479 25	822,107	$145,317 47	5,488

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